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JAN. 31, 1955
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NEWS DIGEST

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Average 5 seconds tuning time for typical international frequency plan (2-22 mcs) on DC-6B. Maximum tuning time 15 seconds.

Requires no frequency information from transmitter or selector switch, therefore can be used with any type of H.F. transmitter having a 52 ohm coaxial output, a nominal carrier power of 50 or 100 watts, and providing necessary control for the tuner.

Requires only 27.5 VDC primary power (1A standby and transmitting, 3A tuning); 50 MA at 400 VDC for only 1 second during tuning cycle.

External RF relays not required, even for dual installation. Tuner is fitted with two front panel mounted RF relays for optional use. One relay operates with P-T circuit and may be used to transfer antenna directly to receiver input circuit; the second relay is used in a dual installation, to ground the antenna when the other transmitter is being used.

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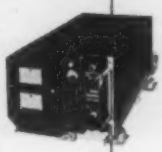

Model AT-144 Airborne Transmitter: Frequency range 1.6 - 1.75 and 2.0 - 22.0 mcs covering 144 independent crystal controlled frequencies. Weight 44 lbs. Separate transmitter and receiver permit cross-band operation.

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NEWS DIGEST

Boeing XB-47D Tests New Wright T49 Turboprops

Boeing XB-47D, with each inboard pair of GE J47 turbojets replaced by a Wright T49 turboprop, undergoes initial taxi trials at Seattle prior to its first flight. The aircraft will serve as a testbed to gather flight performance data on the new T49s, each fitted with Curtiss Turboelectric four-blade wide-chord propellers (Aviation Week Apr. 19, 1954, p. 14). The T49s, able to deliver more than 10,000 eshp. each, are mounted against the undersurfaces of the wings to provide maximum ground clearance for the prop tips.

Domestic

U. S. aircraft industry is turning out 65 different models of airplanes for the armed forces and 26 for the civil market, not including drones and guided missiles, Aircraft Industries Assn. reports. Nine military and six commercial helicopters also are in production. To build these aircraft, AIA says, the industry spent approximately $4 billion during 1954 for subcontracting, materials, fuel and electricity, plus an estimated $3.54 billion to pay 800,000 employes.

New pilotless aircraft is being developed by Northrop Aircraft and its subsidiary, Radioplane Co., at special, segregated facilities in American Motors plant at El Segundo, Calif. A design team of 60 scientists and technicians is working on the secret project.

Color radar scope that uses different colors to identify aircraft altitude, speed or destination was demonstrated to civil and military aviation officials at Washington National Airport last week. The new radar display was developed by Chromatic Television Laboratories under Navy sponsorship.

Pan American World Airways has drawn up plans for a new hangar, large enough to house 10 Boeing Stratocruisers, at New York's Idlewild International Airport.

Member airlines of Independent Military Air Transport Assn. flew more than 591 million passenger-miles during 1954 without a fatality. The 13 companies carried a combined total of 266,525 passengers during the year, 176,421 in domestic traffic and 90,104 on international flights.

Financial

Douglas Aircraft Co., Santa Monica, Calif., will split its stock Mar. 2 for the second time in less than a year, giving holders of record Feb. 2 three shares for every two. The company made a two-for-one split last May. Douglas also has declared a regular quarterly dividend of 75 cents plus an extra 75 cents, payable Feb. 23 to holders of record Feb. 2. Net profits for the fiscal year ended Nov. 30 totaled approximately $14.70 per share, compared with $15.46 for fiscal 1953 before the first split. Sales are estimated at $915,216,705, climbing from $874,515,463 a year earlier. Backlog Dec. 31: $1,964,361,029.

McDonnell Aircraft Corp., St. Louis, reports estimated net earnings of $1,998,817 for the first half of fiscal 1955, dropping from $2,028,210 for the same period of 1954. Sales for the six months ended Dec. 31 totaled $65,758,938, compared with $66,715,018. Backlog Dec. 31: $348,804,610.

Piper Aircraft Corp., Lock Haven, Pa., had a net income of $233,796 during the quarter ended Dec. 31, nearly double the $121,250 for the last three months of 1953. Sales were $3,616,077, compared with $2,733,067.

American Airlines has declared a regular quarterly dividend of $.875 on $3.50 cumulative convertible preferred stock, payable Mar. 1 to holders of record Feb. 15.

International

Over-the-Pole flights will be started by Canadian Pacific Airlines in early May, flying weekly one-stop DC-6B service from Vancouver on Canada's west coast to Amsterdam. The route schedules a refueling stop at Churchill, Manitoba, on eastbound flights and at Sondestrom, Greenland, westbound. Estimated flight time: 18 hr. 30 min.

Nonstop speed record between Mexico City and New York is claimed by Air France for a Super Constellation flight that cut the time on the 2,160-mi. route to 5 hr. 23 min. Previous record, also held by Air France: 5 hr. 35 min.

Guided missile production in Canada can **take care of all needs** of the country's armed forces, reports G. D. Watson of the Canadian Defense Research Board. He says CDRB is developing experimental air-to-air guided missiles for the Avro CF-100 and has produced an accurate rocket for the Canadian army.

Bristol Britannias soon will begin a flight test program aimed at logging 2,000 hr. in the air by mid-1955. Bristol plans to put four of the large turboprop transports into the program, scheduled to precede deliveries to British Overseas Airways Corp.

Trans-Australia Airlines will buy another Vickers Viscount to replace the turboprop airliner that crashed on a training flight near Melbourne last October (AVIATION WEEK Jan. 24, p. 86).

Aircraft Corporation

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NATIONAL AERONAUTICAL CORPORATION

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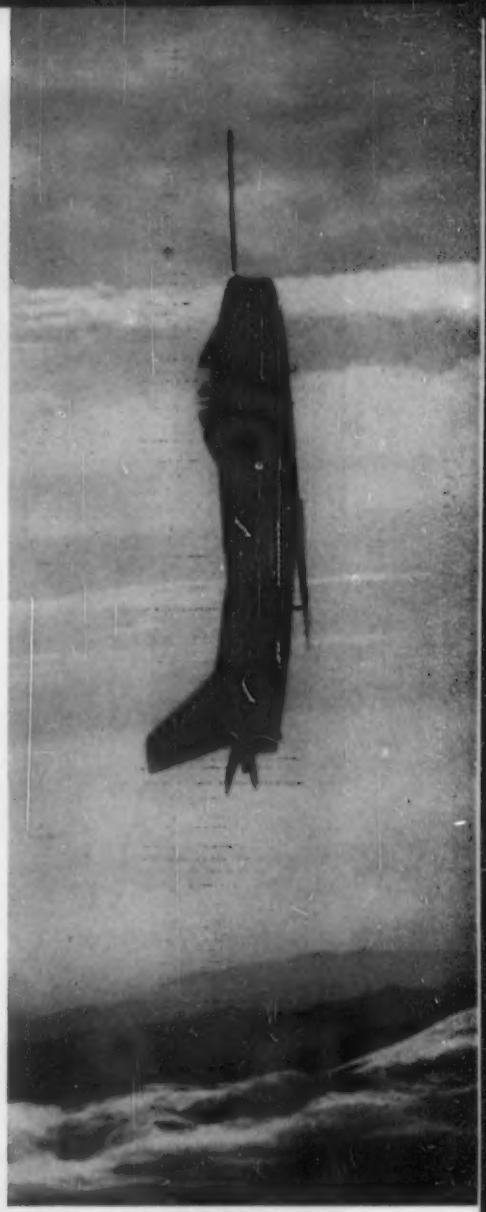
McDONNELL F101A VOODOO recently flew 1,700-mi. from St. Louis, Mo., to Edwards AFB, Calif., in company of Boeing B-47B Stratojet (background). Voodoo joins two other F-101As, airlifted earlier, in flight test program at Edwards. The F101A has two P&W J57s.

New Views of U.S. Military Planes

FLYING CLASSROOM for navigators and bombardiers is Convair T-29C, which carries 14 students and instructors. Second circular station atop fuselage is for periscopic sextant.



VERTICAL CLIMBING North American F-86H Sabre is silhouetted against sky. GE J-73-powered F-86Hs are being delivered to George AFB, Calif., Clovis AFB, N. M.

FJ-4 FURY carrier-based Navy fighters are not towing one another—although close flying creates this optical illusion. Planes, fitted with instrumented nose booms, are on a test flight from North American Aviation's Columbus, Ohio, Division where they are being produced.

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WHO'S WHERE

In the Front Office

Charles M. Green has moved up from executive vice president to president of Sperry Gyroscope Co., Great Neck, N. Y., division of Sperry Corp. Retired president **Preston R. Bassett** will continue as a vice president of the parent firm. **Carl G. Holschuh** is new executive vice president and general manager.

A. J. M. Chadwick, senior vice president of Hiller Helicopters, has taken charge of management controls of the Palo Alto, Calif., company.

Guy N. Tomberlin has been promoted by Riddle Airlines to vice president-operations for Florida, New York and Puerto Rico stations.

John C. Vaughan has become staff assistant to the president of Curtiss-Wright Corp., Wood-Ridge, N. J., also will be manager of the firm's Washington, D. C., office.

Honors and Elections

Dr. Clark B. Millikan, director of the Guggenheim Aeronautical Laboratory at California Institute of Technology, last week received the 1954 Sylvanus Albert Reed Award for ". . . research leadership and guidance in the aeronautical sciences," presented by the Institute of the Aeronautical Sciences at its Honors Night Dinner in New York. Also honored: **Scott Crossfield,** test pilot for the National Advisory Committee for Aeronautics, Lawrence Sperry Award for "important contributions in aeronautical flight research . . ."; **Dr. James P. Henry,** Air Force research physiologist, John Jeffries Award for "outstanding contributions to the advancement of aeronautics through medical research," and **Hermann B. Wobus,** meteorologist for U. S. Navy's Bureau of Aeronautics, Robert M. Losey Award for "outstanding contributions" to aeronautical meteorology.

Igor I. Sikorsky, engineering manager of United Aircraft Corp.'s Sikorsky Aircraft Division, has won the 1955 James Watt International Medal, one of the highest honors of the British Institution of Mechanical Engineers.

Paul Garber, curator of the Smithsonian Institutes's National Air Museum, has been awarded the Washington Air Derby Assn. Trophy for 1954.

Changes

E. M. Bimberg is new general manager of Bendix Aviation Corp.'s Zenith Carburetor Division, Detroit. **Adam E. Abel** has become director of engineering and research for Bendix Radio Communications Division, Baltimore.

Capt. Don Gray has been appointed manager of Central African Airways' new Traffic Division. Other changes: **G. R. Oliver,** manager of the Personnel Division; **W. L. Stedman,** sales promotion manager; **Capt. J. R. Orbell,** chief pilot, and **R. P. Hartley,** chief accountant and secretary.

(*Continued on page 27*)

INDUSTRY OBSERVER

► Full-delta carrier-based jet fighter and a large new amphibian, to be powered by four turboprop or turbojet engines, are on the drawing boards at Grumman Aircraft Engineering Corp., Bethpage, N. Y. The amphibian will follow the general configuration of Grumman's SA-16 Albatross but probably will have a slender, blended hull.

► **Civil Aeronautics Administration plans to install radar beacon ground equipment (secondary radar) at five major airports this year, following Air Transport Assn.'s assurance that several airlines operating into these airports would install cooperating transponder beacons in order to speed evaluation (Aviation Week Nov. 8, 1954, p. 11). Installations are presently planned for LaGuardia, New York International, Newark, Washington National and Chicago.**

► Sncan, French aircraft builder, is showing plans for its high-wing transport powered by two Rolls-Royce turboprops and two Turbomeca Palas turbojets at the wingtips. Designated the Nord 2600, the transport is designed to carry 40 passengers at 295 mph. Wingspan would be 95 ft., range from 627 mi.-932 mi.

► **Second Lockheed C-130 USAF turboprop transport has made its maiden flight, from Burbank to Palmdale, Calif.**

► First test of the Boeing-developed jet engine thrust reverser will be on the 707.

► **Helicopter base operators soon may be doing Army and Air National Guard maintenance work. Likely first contract: New England Helicopter Service, Providence, R. I., to overhaul rotary-wing aircraft for First Army, and Rhode Island and Connecticut ANG.**

► Boeing plans to pressure-test the nose section of a KC-135 fuselage in a manner similar to the underwater tests on the British Comet.

► **Lockheed Aircraft Corp.'s jet transport design calls for swept wings, despite its well-known straight-wing philosophy.**

► Douglas Aircraft Co.'s DC-8 jet transport design calls for pattern speeds, approach speeds and stall speeds with no appreciable difference from present airliners. Takeoff field length is to be as good as or better than that for the DC-7.

► **Lockheed Aircraft Corp. has found two disconcerting characteristics in the turboprop aircraft it now is flight testing, the C-130 and R7V-2. One is a floating tendency near the ground; other is ineffective elevator control on approach resulting from loss in the slipstream over the tail in the approach condition.**

► The ROR—rocket-on-rotor—device to improve lift of helicopters requires 300 lb. of fuel for six minutes of operation.

► **A total of 172 transport aircraft will be manufactured and delivered by the U. S. aircraft industry over the 25-month period from October 1954 through December 1956, according to Air Coordinating Committee. Of the total, 114 are for domestic airlines, 41 for foreign airlines and 17 on manufacturer's production orders. ACC reported production of non-carrier civil aircraft from October 1954 through March 1957 would total 10,927. Schedules call for delivery of 4,370 in 1955; 4,498 in 1956, and 1,213 in the first quarter of 1956.**

► USAF will not finance construction of new industrial facilities on the West Coast if it is possible to avoid it. Contractor must have unbeatable argument to overcome this stand, taken in the interest of forcing dispersion. Policy has given rise to false rumor: that new avionics contracts will not be placed in that area.

Washington Roundup

Profit Limitation

A statute putting a 12% profit ceiling on aircraft defense contracts is now in effect. It became effective with the Dec. 31 expiration of the renegotiation law that suspended it.

Although aircraft manufacturers' profits average out less than 12%, some industry observers are concerned because the limitation applies to contracts individually. A contractor could not apply a profit over 12% on one contract against losses on other contracts. Outlook is that the statute, a part of the Vinson-Trammell Act, will be repealed.

Bright Feeder Outlook

First priority in civil aviation at this session of Congress is going to legislation providing permanent certification of the 14 local service airlines. The drive moved forward with introduction of a measure by the chairman of Senate Interstate and Foreign Commerce Committee, Sen. Warren Magnuson.

Two House members—Reps. John Bell Williams and Carl Hinshaw—already have introduced a similar measure.

Permanent certification of the local lines is one provision in the omnibus bill proposed by Sen. John Bricker, the top Republican on the Senate Commerce Committee. Under Magnuson's bill, the Board could specify temporary certification to the unpromising segments of a local line's system.

Subsidy Foe Out

Severest Capitol Hill critic of airline subsidies, Rep. John Rooney, has been replaced as chairman of the appropriations subcommittee that handles funds to finance them. The subcommittees on State Department and Commerce Department were separated. Rooney took the State Department chairmanship, leaving Rep. Prince Preston as chairman of the Commerce group.

Last year, Rooney wanted to slash Civil Aeronautics Board's $73-million request for fiscal 1955 payments to $23 million, and harangued Republicans for supporting $40 million.

He will continue as a member of the commerce subcommittee, however.

Aviation Posts

Congressional appointments of interest to aviation:

• Sen. Andrew Schoeppel as ranking Republican on the aviation subcommittee of Senate Commerce Committee. He favors a completely regulated air transport industry and aggressively led questioning that was antagonistic to North American Airlines and other nonskeds at committee sessions last year.

Other appointments to the aviation subcommittee, headed by Sen. Mike Monroney: Sen. Frederick Payne, who defeated former Sen. Owen Brewster; Sen. George Smathers, and Sen. Alan Bible, who fills the seat of the late Sen. Pat McCarran.

• Sen. John Sparkman, strong supporter of the nonskeds, as chairman of the Senate Small Business Committee. He probably will head the military subcommittee, slated to investigate Defense Department procurement policies this session.

IMATA, ACTA Merger?

Independent Military Air Transport Assn. and Air Coach Transport Assn. are making a concerted effort to arrange a merger so there will be "a unified independent air carrier industry." IMATA president Ramsey D. Potts and ACTA president H. B. Johnston are now working out an agenda of subjects to be considered in a merger. This will be turned over to a 14-member committee, seven members from each organization. Several past merger attempts have failed.

Air Force Shakeup

Industry can expect more emphasis on mobilization planning in dealing with the Air Force. USAF disavows any connection with Defense Secretary Wilson's recent order to broaden the mobilization base (Aviation Week Dec. 20, 1954, p. 12), but effective Feb. 1 the mobilization problem will be on the desk of one of its more dynamic young executives—Brig. Gen. Thomas P. Gerrity.

Administrative shakeup involves abolishment of the directorate of industrial resources, formerly headed by Brig. Gen. F. E. Calhoun, who has a new assignment outside the Pentagon. His deputy, Col. W. R. Carter, is merging his office with Gerrity's. Latter's title now is changed from director of procurement and production engineering to director of procurement and production.

This setup is not new. Both functions were in one office prior to the Korean war, were split in order to cope with critical problems involving utilization of bricks and mortar, tools, scarce materials. Planning for mobilization went along with the rest of the chores.

Now the hot issues of 1950 have cooled, mobilization planning is more important than the expediting of hardware. USAF also feels reorganization will be economical, save space and manpower while bringing two closely related functions back into the same bailiwick. In addition, the alignment is more comparable to that of Air Materiel Command.

Nebraskan to CAB?

Strong possibility that President Eisenhower will nominate Chief Justice Robert G. Simmons, of Nebraska's Supreme Court, to Civil Aeronautics Board has air transport observers wondering about his views on civil aviation.

Justice Simmons' lack of a background in civil aviation may be one of the reasons he was tapped for the CAB vacancy. White House was embarrassed when the first choice, Harold A. Jones, U.S. representative to the International Civil Aviation Organization and a former Board member, was vetoed by the local service airlines (Aviation Week Jan. 17, p. 12).

White House sought a candidate who was not controversial, had the stature of a judicial background, knew how to deal with Congress—and is a Republican. Justice Simmons meets these criteria. Only discernible background in aviation is his service as a balloon pilot in World War I.

Prime movers in promoting Justice Simmons apparently were Assistant Secretary of Defense Fred Seaton and Under Secretary of Interior Clarence A. Davis, both fellow Nebraskans, who carry weight at the White House. Justice Simmons was cleared with Nebraska Senators Roman Hruska and Carl Curtis by the Republican National Committee. —Washington staff

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Guided Missile Program Reaches 'Pay-off'

- **Big orders in fiscal '56 to increase U. S. output.**
- **Experts believe the Atlas still is weapon of future.**

By Claude Witze

Defense Department is confident its guided missile development program has reached the "pay-off" stage.

Substantial production orders in fiscal 1956 will point the way to increased missile output by U. S. aircraft and electronics manufacturers. Defense policy will be to buy them under the weapon system concept, but prime contractors will be forbidden to expand into alien fields.

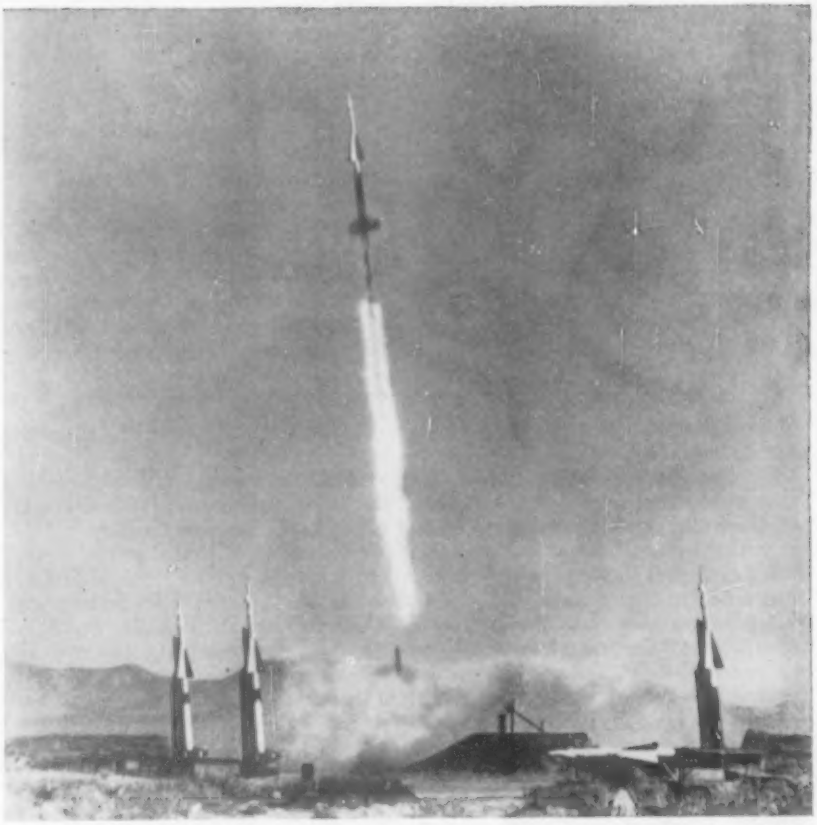
A top Defense Department executive said last week: "If the prime contractor . . . imagines he knows how to do all parts of the system, you are doomed to failure."

▶ **Procurement Doctrine**—The department's viewpoint on maintaining this division of industrial competency in the guided missile field conforms to Air Force policy for weapon system procurement as outlined by Lt. Gen. Bryant L. Boatner (AVIATION WEEK Jan. 17, p. 13).

"You have got to have (the prime contractor) bring in expert contractors in the fields in which he is not expert," the Defense official said. "And the systems that I know of that have worked well have been of this pattern. . . .

"There have been some people, some contractors, who imagined that if they didn't know a particular game they could build up the competence to do it in a fairly short time, and I think frequently people of that kind have found there was more in the game than they realized. We are industrially organized, different industries have different special competencies and I think we in the military ought to try to pull into these projects the best special competencies that are needed to do the job."

A suggestion that the Army's Nike made fast progress because an electronics manufacturer (Western Electric) had the prime contract, while an aircraft company (Douglas) assembled the missile as a subcontractor, was not confirmed. However, indications are that the key importance of guidance components will give the electronics industry a bigger role in future weapon contracts.



HIGHER MISSILE OUTPUT is in the cards following success of initial units such as Nike.

Supporting this thesis is the known example of another missile project in which production was delayed for a year and a half because the item off the assembly line did not perform in the pattern established by the custom-made prototype. The prime contractor in this case was an aircraft firm.

▶ **Military Economy**—It also is clear that increasing amounts of money for missile production orders in the next few years will be made available through curtailment of purchases in other fields —notably aircraft.

"We have to look at (production) in terms of the overall military economy," a Pentagon spokesman said, "and we have to be able to get our missiles out of our total allowable resources—or our airplanes, if we want airplanes instead of missiles.

"We don't consider that guided missiles are a new starter in this business, so you add the expense of guided missiles to everything else.

"We consider that guided missiles are just part of our arsenal that we will add to the arsenal as they become economical in relation to other things," the Defense spokesman said.

This essentially conservative approach to the missile problem—and there are service demands that a "crash program" be instituted to meet the Russian challenge—evidently will be followed by the Defense Department right from the beginning, with research and development.

In the R&D field, the spokesman said, Defense is "trying to maintain about an even keel . . . so there isn't any grand buildup."

▶ **Best Future Weapon**—Here the viewpoint has particular bearing on America's need for an intercontinental ballistics missile (IBM) that may be the best practical future weapon for atomic retaliation in case of attack. Both guidance and propulsion problems must be

Hypersonic Tests Near Mach 20

Mach 20 speeds are the next step in a planned program of hypersonic testing at James Forrestal Research Center at the Gas Dynamics Laboratory of the Princeton University.

First details on the center's hypersonic research program were reported recently by Prof. Daniel C. Sayre, director of the center, who said the results now obtained at steady Mach 15 speeds culminate eight years of pioneering work by Prof. Seymour Bogdonoff, of the Princeton Department of Aeronautical Engineering, and his associates.

Key to attaining such speeds is the use of helium as the working fluid in the windtunnel.

Bogdonoff said the research center hopes to establish a series of guideposts for the study of fundamentals in a little-known region.

". . . Existing theories enable us to predict only general trends at hypersonic speeds, for they deviate quite strongly from factual values obtained in the laboratory. . . .

"Our first results, for instance, point to the necessity of modifying the hypersonic theories concerned with such phenomena as boundary layers and heat transfer."

The tunnel developed by Bogdonoff's group uses a vacuum ejector system downstream of the test section. Discharge is to atmosphere. It is one of six tunnels at Princeton that together can simulate the range of altitudes from sea level to 150,000 ft. and speeds from about 700 mph. to 17,000 mph. The center believes this is the widest range of test conditions available anywhere in the world.

solved before an IBM can be put in action.

Closemouthed on the timetable, Defense spokesmen said the new 5,000-mi. IBM test range running from Florida to the Ascension Islands is not ready and they do not know when it will be. Reasons:

- They have not yet obtained the right to use all the real estate.
- The course is far from being instrumented fully for test firing, and it will not be equipped "until we need it."
- There will be no IBM ordered into production until Defense is certain the missile will do a better and more economical job than is possible with a piloted airplane.
- There will be no IBM fired at all until "they are accurate enough to deliver the payload with a fair probability into the target area."

▶ **Accuracy Problem**—IBM guidance problem comes essentially from the fact that once the missile has burned up its fuel or left the atmosphere, there is no way to control it. The ballistic missile must be on the right course before this happens.

After control is gone, the IBM will travel over a natural parabolic path similar to that of a shell fired from a gun. The speed must be high: Mach 12 or 13, about 9,000 mph., for a range of only 1,000 miles.

Goal is to build an IBM that will be so accurately aimed by the time it enters a ballistic course that it will hit within 10 miles of a target 5,000 miles away. In some cases, the lethal blow of its warhead might not be an explosion on impact. It could be an atomic or nuclear blast overhead to cover the target area with radioactive fallout.

Major sources of error in guiding this type of missile:

- **Intelligence error.** It is possible that we do not know exactly where the target is in the enemy's territory.
- **Geodetic error.** Maps of the enemy's territory may not be properly matched to the geography of the launching area.
- **Gravity and air currents.** Neither is constant at varying altitudes and over different parts of the earth.
- **Instrument error.** Gyroscopes are essential to some longrange guidance systems. They are not reliable, and a large part of the work done on IBM so far has been devoted to improving their accuracy.

Known IBM project is Convair's Atlas. Two cruise guided missiles, the Northrop Snark and North American's Navaho, will have comparable range. USAF has established a special office on the West Coast to supervise their development.

▶ **Nike Defense**—In the face of critical potshots at the Army's Nike, sometimes accused of inability to hit a modern highspeed jet bomber, Defense Department said the missile can reach anything "of the altitude and speed and of the maneuvering qualities that we have any reason to expect to encounter."

Present high dependence on Nike for protection against enemy bombers results from the fact that, so far as is known, an enemy aircraft would have to get within range of the surface-to-air missile before it could launch an attack on a protected target.

The reason: There is no known air-to-surface guided missile that could be launched from outside the defense perimeter and hit the target. Pentagon hopes it will be a long time before such a weapon is perfected.

"We are glad that it is a kind of tough problem," said one expert, "and we will be trying to extend the range of our own defensive weapons—hoping to get there before they do."

▶ **Missile Facts**—Other guided missile facts currently emphasized at the Pentagon:

- **Experts** are needed to service missiles, but the armed forces can train the average GI to operate them. One objective in development work is to keep the weapon's demand for high skill down as far as possible, but this objective is "not always achieved."
- **Propulsion advances** are needed in the area of reduced engine weight, better specific fuel consumption, better reliability.
- **Nuclear power** could be used for missiles, but cost of the engine would be high for a weapon making a oneway trip.
- **The Navy's Sparrow,** air-to-air guided missile, will be used by both Navy and Marine air arms. The Terrier, surface-to-air weapon designed for launching from a ship, is being adapted to Marine tactical use, launched from land.
- **The Air Force Bomarc,** surface-to-air missile, was announced prematurely, in the opinion of the Defense Department, considering "the stage of development where Bomarc now is." USAF's Falcon, air-to-air weapon, is approaching operational use and will be standard equipment before the Bomarc missile is introduced.

Industry Maps Plans For AF Simulators

Recommendations designed to improve the programming, development and modification of electronic flight simulators have been drafted by industry representatives and submitted to the Air Force for approval.

Ideas aimed primarily at better integration of flight simulators with individual weapon systems grew out of a two-day meeting at the Pentagon, where 130 manufacturing representatives from the aircraft industry and trainer makers conferred with USAF experts on current problems (AVIATION WEEK Jan. 24, p. 15).

▶ **Earlier Deliveries**—Major topic at the meeting was the need for earlier delivery of simulators—"the right trainer in the right place at the right time"—to improve USAF training.

Procurement of the simulator well in advance of the weapon system was discussed as a possible way to speed development, particularly by making it possible to study cockpit configuration and pilot reaction before the aircraft itself is in production.

▶ **Design Flexibility**—Presentations were made by the Air Materiel Command on

modifications and by Aircraft Industries Assn. on the need for design flexiblity and close liaison between the aircraft and simulator manufacturers.

National Security Industrial Assn., through its flight simulator committee, offered data on timing, procurement, target dates and the general state of the art.

Military speakers at the meeting included Maj. Gen. N. B. Harbold, director of USAF personnel procurement and training in the Office of the Deputy Chief of Staff for Personnel, and Brig. Gen. B. S. Kelsey, acting director of research and development in the Office of the Deputy Chief of Staff for Development. Col. A. J. Perna, chief of USAF's Special Training Devices Division, was chairman.

Far East Airpower Showdown Near

Planes of 7th Fleet, equipped with tactical A-bombs, will back up 'fight-if-we-must' doctrine off Formosa.

U.S. airpower assumed new importance in the Far East last week as President Eisenhower laid down his fight-if-we-must doctrine in the face of Red China's threat to invade the Nationalist bastion of Formosa.

The President by implication warned the Chinese Communists that they will have to attack the U.S. 7th Fleet if they attack Formosa, and the fleet will respond by sending its airpower to attack Chinese targets. The 7th Fleet is equipped with tactical atomic bombs and will use these on worthwhile military targets.

▶ **Tidying-up Operation**—Sources close to the White House called the policy a tidying-up operation. Included are steps to withdraw Chiang Kai-shek's Nationalist forces to Formosa and the Pescadores, not only from the Tachens but later from the other coastal islands —including Quemoy and Matsu, located just off the China mainland.

Eventually, it is hoped, all fighting in the area will end.

The President and Secretary of State John Foster Dulles, who took the lead in drafting this plan, base their policy on the conviction that the U.S. is infinitely stronger today than ever before, especially in terms of airpower. This strength, they believe, enables the U.S. to force the issue and bring the Formosa question to an end once and for all.

▶ **Support from Conquest**—Almost as the President acted, three carriers—the Kearsarge, Essex and Yorktown—were dispatched from Manila to reinforce Vice Adm. Alfred M. Pride's 7th Fleet in the Formosa area. They joined the carrier Wasp, already on duty. The Midway also was ordered to the scene, presumably to relieve the Wasp. The carrier Princeton is attached to the 7th Fleet but is located outside the Formosa area.

All of the aircraft carriers are equipped with straightwing Grumman F9F-5 and McDonnell F2H jet fighters and piston-engine Douglas AD-6 attack bombers.

In addition to the carriers, Adm. Pride was reported to have three cruisers and 40 destroyers in his fleet. One of these is his flagship, the cruiser U.S.S. Helena.

▶ **Backing by Congress**—Congressional support for the President was prompt and virtually unanimous.

Within hours after the request was made, the House Foreign Affairs Committee unanimously approved a resolution authorizing the President to employ military forces to secure and protect the Formosa area.

Shortly thereafter the House itself demonstrated its approval of the action by an overwhelming 409-3 vote.

There was some politicking: Democrats maintained that, as in the case of Korea, the President could act without congressional legislation. Republicans, on the other hand, applauded President Eisenhower for bringing Congress into the picture.

▶ **FEAF Alert**—The Far East Air Forces, commanded from Tokyo by Gen. Earle E. Partridge, is certain to see action if shooting starts.

The Far East Air Forces (FEAF) consists of 14 wings:

- Two light bomber (B-26) wings in Japan.
- Four fighter-bomber (F-84, F-86F) wings. Two are in Japan, one each in Korea and the Philippines.
- Three fighter-interceptor wings (F-86D, F-86F). Two are in Japan and one in Okinawa.
- One tactical reconnaissance wing in Japan. It is equipped with F-84s, F-80s, F-86s and B-26s.
- Three troop carrier wings, plus one extra group, also in Japan. Equipment consists of C-46, C-119 and C-124 transports.
- One Strategic Air Command rotation wing of B-36 bombers is on duty in Guam.

Subservient to FEAF are the 13th AF in the Philippines, the 7th AF and Pacific Air Force in Hawaii. The latter, a new organization activated last summer under the command of Maj. Gen. Sory Smith, has no operational aircraft assigned to it.

Britain Acts to Speed Aircraft Production

A special British ministry, organized to give continuity to the prolonged process of development and production of aircraft, is being considered by Prime Minister Churchill.

Churchill's views became known in the course of a House of Commons discussion on aircraft production.

▶ **'Appalling Delay'**—Laborite Woodrow Wyatt proposed that the system now governing production should be overhauled completely in view of the "appalling delay" in deliveries. Churchill replied that the increased complexity of modern aircraft, coupled with the rapidity of new developments, was such that the process of construction exceeded the "life" of an individual Minister of Supply as much as three times.

"It certainly raises in my mind," Churchill said, "the broad general question of whether a special ministry should not be recreated to deal with the prolonged process of production."

Churchill rejected a Labor suggestion for a committee of inquiry to investigate production difficulties.

▶ **Pre-production Plan**—The Prime Minister said he thought production delays because of accidents, too few prototypes and unfortunate events would not result in a disadvantage to Britain. He believed they would be settled "before the period of comparative safety, in which we are living, has elapsed."

Tendency at the present time is to wait for the long-sought results before making any drastic changes. Production appears to be improving with three squadrons now equipped with Hawker Hunters. Delivery of Vickers Armstrongs Valiants has started, with present schedules calling for two a month. The first production Avco Vulcan will be rolled out in a few weeks.

In addition, Britain also has adopted a version of the USAF Cook-Craigie plan, designed to close the gap between prototype and full-scale production. The Ministry of Supply is using this plan in the English Electric P.1 project. A pre-production order for 21 aircraft has been placed.

Temporary Rents Set On Government Tools

Interim regulations setting rental charges for government-owned machine tools used by defense contractors have been issued by the Pentagon.

The instructions will be enforced, according to T. P. Pike, Assistant Secretary of Defense for Supply and Logistics, until a permanent policy is issued

as part of the Armed Services Procurement Regulation.

Cost of using government tools will be based on their original value. If new since 1950, the rental is 2% per month; 1½% if they were purchased between 1942 and 1949, and 1% if they were bought before 1942.

The directive provides for exceptions to the rental rule when the equipment is located in a government-owned plant or if the armed forces want to locate the tools to conform with mobilization plans. In these cases, the charge for use of government tools may be negotiated separately.

Assistant USAF Secretary Warns . . .

U.S. Needs Long-Pull Mobilization

Lewis tells IAS that the country is weakened by poor weapons produced under haphazard crash programs.

A plague of "too much too soon" faces U. S. military services unless the nation's technical decisions are guided by careful planning and co-ordination to avoid premature commitments, Roger Lewis, Assistant Secretary of the Air Force for Materiel, believes.

Lewis told the Honors Night Dinner of the Institute of the Aeronautical Sciences last week in New York that in ". . . the age of peril, it is clear that we must avoid any haphazard crash program."

He made a strong case for the "long-pull" theory of mobilization. His reasoning:

• Nuclear weapons and longrange aircraft on both sides mean we must maintain a high level of readiness rather than a series of peaks.

• Today's complicated weapons are taking increasing lengths of time in research and development.

▶ **Basic Faults**—Lewis said that in past programs, the U. S. occasionally has suffered from three basic faults:

• **Poor conception.** ". . . We have bought interesting weaponry which either did not fill a clear military need or was inadequately thought out technically. In such cases, no amount of improvising or patchwork succeeded in putting it right.

"Such programs were wasteful, but what was more serious was the fact that completion of a poor weapon weakened us. If it could be used, although poorly, it was but a substitute for something that should have been provided. If it did not work, it, of course, created a deficiency—a hole in the general weapons inventory."

• **Lack of resolution** in canceling outmoded projects. "It is the nature of our business that we should try things which may not work, or try more than one way of accomplishing the same end, or occasionally gambling on a major technical advance.

"This is necessary and good and should be continued vigorously. But if we are to make the most of this exploratory approach, it is mandatory that we be firm, ruthless and quick to halt projects which do not confirm their earlier promise . . . the insidious part of staying with a bad idea is that it prevents you from moving ahead with a good one."

• **Weapons planning** and control. "Many a fine weapon which has been produced at great cost has worked out well but still did not add one ounce to the airpower for which it was bought. Because of some deficiency, it could not be put into the inventory as planned. A late air weapon . . . is often like a ticket to yesterday's ball game."

▶ **'Healthy' Programs**—Lewis confirmed the end of the "feast or famine" days. ". . . We have done away with a 'particular crisis' target date. We are now able to consolidate our development programs into a more healthy state, recasting them in terms of realities. The job will be done better, and the cost will be less. We now realize that the size and impetus of research and development programs cannot be adjusted up or down according to the particular fortunes of a given year, or in accordance with what an enemy may or may not be doing.

". . . Our approach to superior weapons must be positive—based on the best that we can do to wring from our technological society the best that is in it. There are no monopolies in science. No counter puncher is ever a champion."

He described the establishment of USAF's Air Research and Development and Air Materiel Commands as its solution to living with the conflict that crops up among the military, science and industry.

"The establishment of a separate command," he said, "and the appointment of a deputy chief of staff for development reflect the importance attached to scientific research and development activity in air weapons and techniques.

"The reduction of this command structure to practice has not been without difficulty—as might be expected from changes of this magnitude in an organization the size of the Air Force. But it is our way—the way we see by which we can get the best of two worlds."

Lewis said the present organization is working well.

"Conflict is inherent in the interests of the scientist, the militarist and the industrialist," he said. "There is strength in the conflict if it is used. But it requires understanding, communication and mutual respect among the partners if it is to contribute to our common goal. It is a marriage of equals. It is an adult relationship."

French Producing Jet Copters

Two-place Sncaso S.O. 1221 Djinn trio marks beginning of production of pressure-jet-powered helicopters by the French company. Powerplant is a Turbomeca Palouste gas generator of about 240 hp. All three helicopters have wheel-skid landing gear.

5th Amendment Pilots To Get Court Ruling

Civil Aeronautics Administration is asking the courts to determine how far privileges guaranteed by the Fifth Amendment extend in cases and actions taken by a federal agency such as CAA.

A petition has been filed by CAA in the U. S. Court of Appeals for the Dis-

trict of Columbia Circuit, asking the court to review a decision of Civil Aeronautics Board that barred CAA from taking action against two United Air Lines pilots.

▶ **Self-Incrimination**—The CAA action stems from the results of a mid-air collision between American Airlines and United Air Lines Convairs over Michigan City, Ind., Aug. 26, 1953. Despite serious damage, both planes landed safely and no lives were lost.

When CAB called the pilots to testify in the accident investigation, UAL pilot Lewis H. Brubaker and co-pilot Charles E. Olsen claimed the privileges against self-incrimination. They were ordered to testify, and both complied.

Last February, CAA filed complaints against Brubaker and Olsen based on testimony given in the investigation. CAA wanted their pilot certificates suspended on grounds that they failed to exercise sufficient vigilance and had flown the United Convair in a careless manner.

▶ **No Prosecution**—Brubaker and Olsen answered they were granted immunity to "penalty or forfeiture" under Section 1004(i) of the Civil Aeronautics Act, which sets the rules on self-incrimination in the taking of evidence.

This section says in substance that no one shall be excused from testifying before the Board in any proceeding growing out of alleged violation of the Act on the grounds of self-incrimination. But it also says no witnesses shall be "prosecuted or subjected to any penalty or forfeiture" on the basis of testimony he has been compelled to give, except in perjury.

In practice, this amounts to trading immunity for information on the theory that it is in the public interest to obtain the most complete reports available.

▶ **Matter of Interpretation**—CAB investigators found that both crews were guilty of a lack of alertness but placed the primary blame on the UAL pilots.

Last August, the Board issued a decision dismissing the CAA complaint. It said CAA was seeking a disciplinary suspension and that the immunity granted covered such action.

CAA said the court should decide who has made the most nearly correct interpretation of the law.

▶ **Not Punitive**—In dismissing the complaints, the Board held that Section 1004(e) ". . . . does not bar suspensions of an airman certificate . . . where suspension is necessary to protect the public from an unqualified pilot, but that it does bar suspensions imposed primarily because of violations of the Civil Air Regulations where the pilot is otherwise qualified."

CAB said in its decision that the CAA could file new complaints if it wanted to make a case proving the pilots were unqualified to fly.

▶ **Issues, Laws**—In its brief to the court, CAA takes issue with the Board's stand. It says the CAB erred:

• In holding that suspensions "imposed to prevent and deter safety violations" of the CAR are punitive and are a type of penalty covered by the immunity granted under Section 1004.

• In holding that pilots compelled to testify on an accident are granted immunity, after they claim self-incrimination privileges, from suspension based on conduct about which they testify.

• In dismissing the complaints against pilot Brubaker and his co-pilot Olsen.

• In holding that Section 1004 immunity extends to suspensions of certificates imposed to prevent and deter safety violation.

The issues and laws in the case are not clear on either side and make ripe material for judicial interpretation. The core of the controversy lies in the question of the scope of the statute and whether this type of penalty is covered. The constitutional guarantee on self-incrimination applies only to criminal action.

Reds Add New Fighter to Arsenal

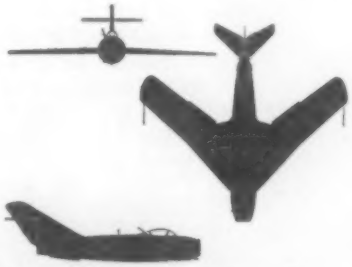
Fresco, a new Russian fighter with a familiar resemblance to the MiG 15, is the latest officially announced addition to the Red fighter arsenal.

Major difference is in the new fighter's unusual wing planform, showing several aerodynamic tricks for increasing its critical Mach number and its ability to maneuver at altitude.

In many ways, Fresco compares to the Falcon, the original MiG 15, as North American Aviation's F-86H Sabre compares to the earlier F-86s that fought in Korea. Fresco may have been engineered hastily from the specific lessons Russia learned in the Korean theater.

In addition to its jagged wing shape, Fresco has a tail configuration clearly based on that of the MiG 15 but modified for additional strength, structural stiffness and improved control.

Provisional silhouette and photographs of recognition models of Fresco and Falcon appeared in Naval Aviation News (official publication of the Chief of Naval Operations, Bureau of Aeronautics). The same magazine earlier published first drawing and code names of Russian bombers (AVIATION WEEK Oct. 4, 1954, p. 15).



FRESCO silhouette shows changes from . . .

FALCON, standard MiG jet fighter.

Research Goals

- **NACA aims for nuclear engine, better turbojets.**
- **Group says Russian air progress challenges U. S.**

Improvement of turbojet engines and development of nuclear powerplants are prime goals of aeronautical research in the immediate future, National Advisory Committee for Aeronautics said in its annual report last week.

Citing Russia's open display of jet bombers in 1954, the report said Soviet air progress is "challenging," adding that "how close the race has become, we cannot know with certainty." Powerplant problems are:

• **Turbojet progress** has been "spectacular" in the past few years with a six-fold increase in the thrust of production engines; but "large gains must yet be made to enable the deep penetration into the supersonic range by tactical aircraft required for military purposes.

"What are needed, of course, are engines to propel fighters at two or even three times the speed of sound and to power bombers at supersonic speed throughout their longrange missions."

• **U. S. security** demands that research and development on nuclear power for aircraft "be carried forward with unceasing effort." This is necessary "if supersonic aircraft are to possess the ultimate in longrange capabilities."

Perfection of the nuclear aircraft engine will permit supersonic flight to any point on the earth and return.

• **For missiles,** the range of rocket engines can be extended only through more research on fuels. Combinations are needed that will more than double the impulse available to the Germans for the V-2.

▶ **Aerodynamic Problems**—NACA's anual report also said tomorrow's airplanes demand more basic information on "the matter of form or shape of the entire structure, the wings, the engine pod, the fuselage."

These problems become "increasingly critical" as speeds increase and "new structures, new methods of fabrication" are becoming more urgent.

In the past decade, substantial progress has been made on these problems in the transonic area, but further research is needed as speeds increase.

▶ **Research Insurance**—Recognition of these problems was clear in NACA's 1956 budget request of $76.5 million, which included money for new facilities to carry out the program (AVIATION WEEK Jan. 24, p. 15).

In a letter of submittal accompanying the annual report to President Eisenhower, NACA chairman Jerome C. Hunsaker said the fiscal 1955 appropriation of $52 million was forcing deferment of essential research. Research, he told the President, "is the best insurance that there will be value received from the country's whole aircraft program."

To Congress, Hunsaker addressed his warning about Russian progress. The race to acquire scientific knowledge, the chairman said, "starts in the research laboratories."

He added: "Despite evidence of substantial acceleration of technology in Russia, we believe we still have a qualitative lead. Maintaining that lead demands more vigorous attacks upon the research problems before us. Continued effective teamwork by the military services and the aircraft industry can insure early exploitation of research results in practical applications leading to improved aircraft and missiles."

Canada May Buy Gnat For Navy Carriers

(McGraw-Hill World News)

London—Canada is evaluating Folland Aircraft's lightweight Gnat as an aircraft carrier interceptor, possibly as a replacement for McDonnell F2H-3 Banshees now going into service.

Folland already has done an operational and design study of the Gnat for Canadian Navy use, and Cmdr. H. J. Hunter of RCN has been in England to fly the light fighter.

▶ **Carrier-Based Changes**—Modifications for carrier operation would include a heavier undercarriage and an arrester hook. Wings would not have to fold, since the Gnat has a wingspan of less than 21 ft.

Carrier arresting wires would have to be softened to take the Gnat, but this is viewed as no real problem.

Indian air force representatives also are interested in the Gnat and have been here to fly it.

There is interest on the Continent, but it is dormant pending a decision by the North Atlantic Treaty Organization in its light fighter program.

▶ **Gnat Boxscore**—Record of Gnat production to date: One Midge (prototype of the Gnat) structure built for testing; one made for reserve; one flown at Farnborough; one Gnat structure for testing completed; two flying versions under construction, with the first scheduled to appear before Britain's 1955 Flying Display at Farnborough next fall. Supersonic versions (Mark 2 and 3) are scheduled for completion in 1958 and 1959 respectively.

The Gnat's powerplant, the Bristol Orpheus, already is hitting the plane's thrust requirements—three months ahead of schedule.

The British Ministry of Supply has viewed the Gnat, possibly as the result of pressure from Parliament and the Royal Air Force. There is talk that MOS may order a dozen or so.

Highspeed Conference Dedicates Mach 15 Lab

An aerodynamic laboratory, with a windtunnel designed for Mach 15 speeds, was dedicated at a three-day conference on highspeed aeronautics Jan. 20-22 in New York.

Attended by leading aerodynamicists and structures specialists of the free world, the conference was a feature of the Polytechnic Institute of Brooklyn's centennial year.

The hypersonic windtunnel at the institute's new Freeport, N. Y. lab is not completed, but two small units have been in operation at the new facility.

The list of speakers and specialists at the conference read like a who's who of aeronautical science. Senior scientist present was Dr. Walter F. Durand, regarded as the dean of aerodynamics.

Dr. Theodore Von Karman, chairman of USAF's Scientific Advisory Board and of AGARD gave the keynote address on "Solved and Unsolved Problems in Highspeed Aerodynamics."

A series of presentations of scientific research were given by the men who contributed in a large measure to the growth of aerodynamics: Dr. H. L. Dryden, director of research for the National Advisory Committee for Aeronautics; Prof. M. J. Lighthill, known internationally for mathematical treatments of flow problems; Adolf Busemann, German-born scientist now with NACA, whose basic theories of wing design for supersonic speeds have given his name to a series of planforms; Prof. H. Schlichting of Braunschweig, Germany, known for basic contributions to boundary-layer theory.

Chance Vought Gets $3.5-Million Contract

Chance Vought Aircraft, Inc., Dallas, has been awarded a $3.5-million research and development contract by the Navy.

Other recent Navy contracts include:

Allision Division of General Motors Corp., Indianapolis, acceptance testing of gear box assemblies, $197,000.

Sanders Associates, Nashua, N. H., research and development, $185,000.

W. L. Maxon Corp., New York, research and development, $158,000.

Grumman Aircraft Engineering Corp., Bethpage, N. Y., research and development, $115,000; part kits for F9F-6 and -7 aircraft, $3,847,020.

Bowen & Co., Inc., Rockville, Md., synchro signal amplifiers, $125,856.

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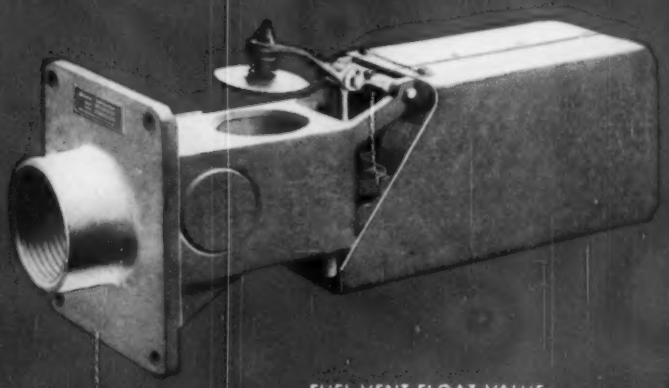

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Third Report from Formosa:

Taipei Bids for More Air Traffic

Nationalist China expects to become major airline link to Far East when new airport facilities are completed.

By Dan Kurzman

(McGraw-Hill World News)

Taipei—Within the next year, Formosa will become one of the most important international airline links in the Far East. These expansion projects now are under way:

- **New airport facilities** at Taipei, including a longer runway capable of handling large modern transports,
- **Airways system** of a very high frequency omni-direction radio range (VOR).
- **Training center,** financed by the U. S. Foreign Operations Administration, to instruct Chinese specialists in air traffic control and aeronautical telecommunications.

These projects, when they are completed in early 1956, are expected to result in an increase of 25% in passenger and cargo traffic to Formosa, which will become a stopover for several airlines that now bypass the island. At present, about 3,500 passengers and 300 tons of goods are unloaded monthly.

The modernization program is being sponsored by the Chinese Civil Aeronautics Administration and directed in large part by a team of five American CAA technicians under FOA's Mutual Security Mission to China.

Expenditures will total about $83,000 in direct FOA aid and $128,500 in local FOA counterpart funds.

▶**7,500 Ft. Runway**—The new Taipei airport runway will measure 7,500 feet, long enough to accommodate planes up to the size of a Boeing Stratocruiser. The present 5,600-foot runway permits only DC-4s and smaller aircraft.

The airport will be fitted with a modern high intensity night-lighting approach system conforming to international standards and an up-to-date all-weather ILS instrument landing system.

A new control tower also is to be built.

▶**Navaid System**—Of parallel importance will be the VOR air navigation aid system.

One station is under construction on the 3,700-foot peak of Ta Tum Shan mountain in northern Formosa and will be completed in March. Two others soon will be installed at Hen Ch'un in central Formosa and at Tainan at the southern tip of the island. This system will permit pilots, now guided by head set radio signals, to use instrument panel indicator needles to keep them on the proper course.

These VOR stations will constitute significant links in a new VHF airway chain extending through the Philippines, Okinawa and Japan.

▶**Traffic Control School**—To provide technicians to operate these various new installations, the FOA-supported American team, headed by Frederic H. Stephens, has set up an Aeronautical Training Center for air traffic control and communications.

Patterned after the U. S. training center in Oklahoma City, this school is using modern simulated equipment approved by the International Civil Aviation Organization.

Fifteen air traffic controllers and 18 communicators are attending the first course, which started in September and is being extended from the normal 13 weeks to 17.

According to their American instructors, these first experimental students (including a few air force technicians) who had already had some knowledge in these specialized fields, are making progress comparable to that of students at the Oklahoma City center. It is estimated that in about six months, some of the trainees will take over classes from the Americans.

Eventually, students from other Far Eastern countries will be sent to this school, rather than Oklahoma City, for training.

▶**Future Traffic**—When Formosa's expanding civil aviation facilities are completed and the men to run them are trained, at least three international airlines—in addition to the four now routed through Formosa—are expected to operate on this island. Pan-American World Airways has indicated it would like its Hong Kong-Tokyo flight to stop here. Canadian Pacific Airlines has shown similar interest.

The infant Japan Air Lines probably will inaugurate a flight to the island once an air transportation agreement between Japan and Formosa, now pending, is signed.

▶**Triangle Route**—At present, only one trans-Pacific U. S. aircarrier, Northwest Orient Airlines, operates into Formosa. And even this company officially flies only the Taipei-Tokyo (via Okinawa) segment of the Hong Kong-Taipei-Tokyo triangle. It has been denied a franchise to operate from the British colony to Formosa—the result, the NWA complains, of pressure exerted on Hong Kong's government by the two major airlines making the direct Hong Kong-Tokyo flight, PAA and the British Overseas Airways Corp.

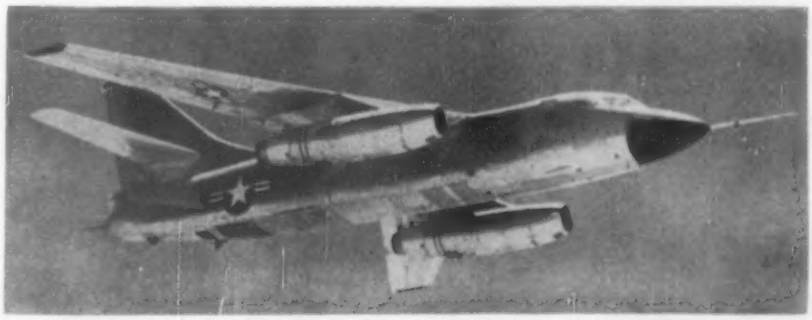
But Northwest has had an arrangement since 1950 with the paper-existent Hong Kong Airways, owned by the Jardine Matheson Co., whereby the latter charters NWA aircraft for the Taipei flight.

▶**Increased NWA Profits**—Northwest planes make six stops a week in the Formosan capital. This may increase when the new airport facilities are ready.

Until recently, the airline's Formosan flights were operating at a heavy loss. But business has improved considerably over the last year and the company is looking forward to a profitable 1955.

It has benefited from an increased Nationalist Chinese program for sending students to the United States and from increases in American military personnel on the island. It expects to profit also from an imminent influx of Formosan immigrants into the United States under Washington's new refugee program.

But Northwest, as well as the other international airlines stopping in For-



Douglas RB-66 Shows Fuselage Airbrakes

New flight view of sweptwing Douglas RB-66 light bomber reveals its airbrakes extended just behind the USAF insignia on aft fuselage. Powerplants are two Allison J71-A-9 turbojets. Plane also is in production for Navy as the A3D Skywarrior.

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mosa, will continue to suffer from the Nationalist Chinese government's dim view of tourism during the tense military situation in this area.

Moreover, NWA's position is not likely to be helped by the enlargement of airport facilities, which will bring in competing airlines.

▶**CAT Transition**—At present Northwest's biggest competition comes from the U. S. financed Civil Air Tansport airline, operating in Southeast Asia since World War II under the guidance of Maj. Gen. Claire L. Chennault.

CAT is in a transitional stage of its development. Until now, the airline has operated out of Taipei on a temporary year-to-year agreement with the Nationalist Chinese government. The country's aviation law provides that a company can maintain headquarters in Formosa on a permanent basis only if one of two conditions is fulfilled: it must either be financially controlled (51%) and effectively operated by Chinese nationals or qualify as a "foreign investor."

The Executive Yuan only recently approved CAT's application for status as a foreign investor. But the airline still might have to satisfy nationalistic sentiment in the government.

▶**Chinese Airline**—To establish the airline as a "Chinese company", CAT's American directors may set up a holding company, 60% controlled by the Nationalists. This company would own only a nominal number of planes but would charter aircraft from the original CAT, which would remain in American hands.

Under present Formosan economic conditions, it would be all but impossible for the airline to sell stock in the present CAT enterprise to Nationalists to the extent required for its conversion into a Chinese company. This probably is why the government has approved, apparently on a conditional basis, CAT's status as a foreign investor.

If CAT's plans ultimately prove unacceptable to the Nationalist Chinese government, the company might look for a headquarters elsewhere in Southeast Asia. This, however, would be the last resort, for close sentimental ties bind this airline to National China.

▶**CAT Growth**—CAT has expanded considerably in the last few years and now owns 34 aircraft—23 C-46's, six DC-3's, three DC-4's and two PBY's. It has about 94 flight crews, including 25 pilot captains.

Twelve flights a week are scheduled out of Taipei, bound for the Philippines, Thailand, Hong Kong, Okinawa, Korea and Japan. The airline also operates in three Formosan cities in addition to Taipei.

One important advantage CAT has over Northwest Airlines is the fact that it is not a member of the Inter-

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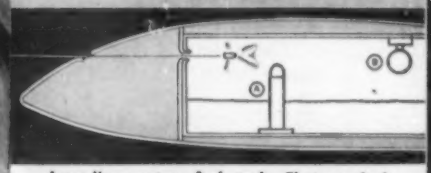
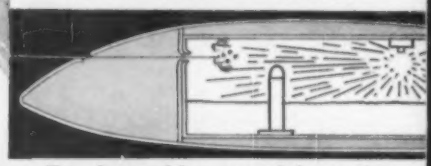
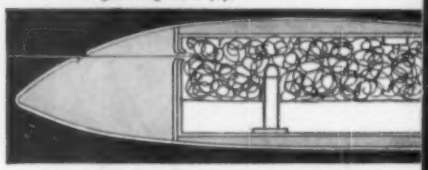


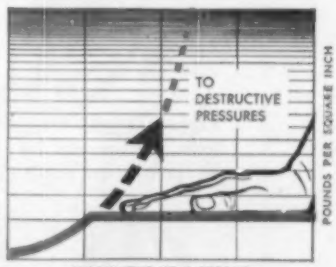
Incendiary enters fuel tank. First spark is "seen" by Fireye Electronic Detector (a).



Fireye Detector (a) counter-explodes container of extinguishing fluid (b).



In millionths of a second the explosion is stripped of its destructive forces. Fireye Fire Extinguisher System protects fuel tank cavities in a similar manner.



Dotted line shows pressure rise during an uncontrolled explosion. Red line indicates course of explosion when extinguished by Fireye.

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national Air Transport Association (IATA) and therefore is able to offer first-class service, including the first-class baggage weight limits, to passengers at rates comparable to and sometimes less than IATA aircoach fares.

CAT also does considerable charter work for various governments and business organizations. Its more spectacular recent services include the repatriation of Nationalist Chinese soldiers from Burma to Formosa, the use of CAT pilots to fly French troops and supplies into Dienbienphu, and transporting North Vietnamese refugees to South Viet-Nam.

In addition to Northwest and CAT, two other international airlines stop in Formosa. Thai Airways makes two flights weekly each way out of Taipei and the Korean Airlines makes one roundtrip to Seoul every two weeks.

► **Formosan Feeder**—Formosa also has one-native owned company—Foshing Airlines. It serves only Nationalist Chinese territory, sharing domestic routes with CAT. Its four planes—three PBY's (one borrowed from a private person) and one C-46 (leased from the government)—makes several flights a week out of Taipei. About half are commercial and half government-chartered.

The airline is directed by one of its four pilots, Moon Chin, a young American-born Chinese who worked for China's Central Air Transport Corp.

With four other ex-CAT employes, he founded Foshing Airlines in May 1951 with a capitalization of $150,000. This is expected to grow to about $450,000 by the end of 1955, when the airline, now just breaking even, hopes to show a profit as the result of government use of its facilities.

It is awaiting delivery from the United States now of a C-46, scheduled to replace the one borrowed from the government. And it hopes to buy a DC-3 in the near future.

The company has applied to fly to Hong Kong, but has been denied the right by the British authorities there.

Moon Chin hopes to expand his infant airline considerably in the next few years, but he has little hope of developing it into a major operation until and unless the Nationalist Chinese retake the mainland.

Loening Urges Buildup Of Air Cargo Network

Development of a vast civil air cargo network by this country is essential to both commercial and military interests, according to aviation pioneer Grover Loening.

► **Fast, Sleek Freighters**—Speaking before the Miami Kiwanis Club, Loening said the general understanding of air cargo is far from the correct one. "Time and again one runs across businessmen whose concept of an air cargo carrier is a big, fat, slow freight-carrying aircraft.

"But the economics of carrying cargo by air prove this to be wrong," he said, holding that airfreight carriers need fast, sleek transport. "The economy of carrying cargo by air is not in the bulk carried in one trip but in the total tonnage carried in one year," said Loening. "If you have a really fast cargo-carrying aircraft, the increased number of round-trips per year piles up the tonnage to a highly satisfactory economic level."

► **'Tremendous Potential'**—He pointed to present development in this country of aircraft capable of carrying 80 tons per trip, observing that such a freighter can pile up as much tonnage in a year as a slow freight-carrying steamship. "What is of the utmost significance," he added, "is that it can do so at considerably less cost per year.

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WHO'S WHERE

(Continued from p. 11)

Richard E. O'Hearn is new Midwest sales representative for Townsend Co.'s aviation engineering sales department. Other new representatives: **James C. Darby**, Eastern U. S.; **E. J. Lowans**, Canada.

Ted Grohs has joined Lear, Inc., Santa Monica, Calif., as special assistant to the board chairman and to the chief engineer.

Joseph W. Baird has been designated military relations representative for Lockheed Aircraft Service, Inc., succeeding **Walter J. Broderick**, who transferred to Lockheed's Georgia Division.

Raymond F. Darney has joined sales department of Flex-O-Tube Division of Meridan Corp., Inkster, Mich., to supervise the company's aircraft product.

P. K. Reynolds has become European sales manager for Canadian Pacific Airlines, with headquarters in London.

Walter P. Balderston has been elected board chairman of Sturgess, Inc., West Coast avionic component affiliate of Pacific Scientific Co. Also elected: **Decker G. McAllister**, president; **Leo Pfankuch**, executive vice president, and **Charles H. Webber**, secretary-treasurer.

Paul P. Rice has been named chief mechanical design engineer for Carmody Corp., Buffalo, N. Y.

Robert Tate has been appointed sales and service manager for the Eastern Division of Servomechanisms, Inc., Garden City, N. Y.

G. A. Johnston has been appointed purchasing agent of Solar Aircraft Co.'s San Diego plant.

Rear Adm. Henry G. Williams (USN, Ret.), has been appointed director of military relations for the Aircraft Products Division of Manning, Maxwell & Moore, Inc., Stratford, Conn.

James M. Mitchell has been named assistant to the director of the National Science Foundation where he will handle fact-finding studies on scientific activities and manpower.

C. R. Lemonier has been appointed to head the recently expanded plastics department of Fairchild Engine & Airplane Corp.'s Guided Missiles Division, Wyandanch, N. Y. **Edmund B. Parke** has been named works manager of the Engine Division.

Arthur A. Worden has been appointed administrative engineer and assistant to the vice president-engineering of Radiation, Inc., Melbourne and Orlando (Fla.) Divisions.

T. C. Wallace, Aviation Products Division manager for Goodyear Tire & Rubber Export Co., Akron, temporarily has taken charge of aviation sales in England. **W. H. Snee** is new assistant division manager.

Armand F. DuFresne has been named to the new post of chief product engineer for Consolidated Engineering Corp., Pasadena, Calif.

J. R. Clark, assistant chief engineer, Chance Vought, Inc., Dallas, Tex., has been given additional responsibility for all aircraft projects. **H. B. Gibbons** has been named assistant chief engineer-technical; **J. W. Larson**, assistant chief engineer-administrative, and **A. L. Jarrett** has been promoted to development chief.

Peter H. Stanton is new contracts manager for G. M. Giannini & Co., Inc., Pasadena, Calif.

Bryce Wilson has been appointed military relations manager for Hiller Helicopters, Palo Alto, Calif.

Leon H. Fish, Jr., has been named manager of Solar Aircraft Co.'s Dayton, Ohio, office.

Percy Halpert has been appointed aeronautical equipment engineering director for Sperry Gyroscope Co., Great Neck, N. Y. **A. L. Coulson** has been name sales manager of the Ford Instrument Division of the Sperry Corp., Long Island City, N. Y.

Wilson H. Benson has been named aircraft maintenance superintendent of Temco Aircraft Corp.'s Dallas, Tex., plant.

Per O. Eden is new traffic and sales manager for KLM Royal Dutch Airlines in the U. S.

Lester J. Maitland has resigned as Michigan civil defense director to give full attention to his post of State aeronautics director.

A. W. McCaghren has joined Winder Aircraft Corp., Winder, Ga., as superintendent of manufacturing.

Sir Alwyn Crow, British rocket expert, has become consultant in England for Aerojet-General Corp., Azusa, Calif.

1955 Bonanza is No. 4,000

The 4,000th Bonanza, a 1955 model F35, was one of the highlights of Beech Aircraft Corp.'s recent distributors meeting in Wichita, Kan. New F35 has a third window on each side of the cabin for improved visibility, shorter prop blades with square tips to reduce tip power losses and higher allowable airspeed for landing gear and flap extension. Powered by a 205-hp. Continental engine the four-placer cruises at 184 mph.

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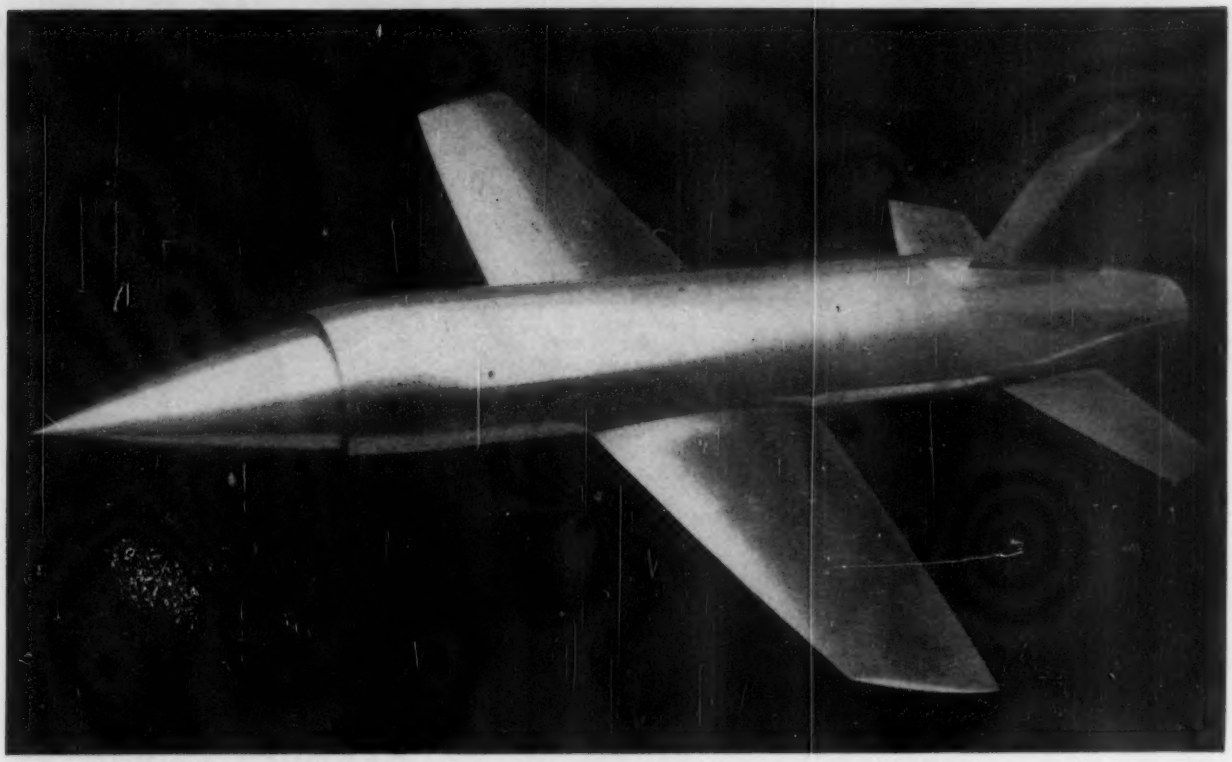


SUPERSONIC MODEL proposed by Miles was to hit 1,000 mph. at 38,000 ft. Was scale-model test program canceled too soon?

RAE's Report on the Miles E.24/43 Tells Story of

The Opportunity That Was Not Seized

The prime danger in free-flight model testing is to bite off more than can be chewed. Too many test points, too-complicated systems, too much demand for information lead engineers into the pitfall of loading everything possible into a few models and a few tests.

If one small failure occurs, the entire complex of instrumentation and data-gathering equipment is lost.

Everybody learns that the hard way. Here is one such chronicle of profit and loss: the story of pioneering British experiments with the RAE-Vickers models of the Miles E.24/43 supersonic aircraft research.

The sparse results of free-flight tests conducted by the British with rocket-propelled models of the E.24/43 did not justify the amount of effort the project demanded.

That is the leading conclusion reached by scientists of the Royal Aircraft Establishment, South Farnborough, England, about the three-year research program on the design and development of the turbojet-powered supersonic research aircraft.

They advised abandonment of the program with rocket-propelled models of the full-scale plane about one year after the Bell X-1 had slammed through sonic speed in the United States.

But in this one case, hindsight was not better than foresight. The Miles project featured an advanced layout with—to name one specific feature—an all-movable horizontal tail. Today one of the chief objections raised to the flight characteristics of Britain's first-line fighters, the Hawker Hunter and Vickers Swift, is that they do not have an all-movable tail.

Engineers here and abroad have speculated that the story might be different had the model tests been pursued actively. They feel that, for one thing, the importance of the all-movable tail for transonic fighters would have been demonstrated vividly by the research program.

► **Brief History**—The original aircraft was proposed by the Miles Co. as a supersonic aircraft, later designated by Specification E.24/43, and also as the Miles M.52. It suffered the major drawback of every advanced aircraft ever designed: There were severe limitations in contemporary aerodynamic, structural, control and powerplant knowledge.

Research test vehicles were proposed, developed and built. The first complete model was ripped off the mother airplane in severe turbulence, carrying to destruction all the prototype equipment. The second model blew up shortly after separation.

The third model, delayed one year because of powerplant troubles, was launched succesfully Oct. 9, 1948. It

This article is based on Aeronautical Research Council's Technical Report R&M No. 2835, "Flight Trials of a Rocket-Propelled Transonic Research Model: The RAE-Vickers Rocket Model," Parts I to IV, by the staff of the Supersonics Division, Flight Section, Royal Aircraft Establishment.

Test Vehicle Chronology

of sonic-speed flight increased, so apparently did the difficulties of that kind

blasted through the Mach 1 mark and on to about Mach 1.4.

But by then the piloted Bell X-1 had done the same kind of job, and the British decided the game was not worth the candle.

▶**Model Growth**—The original models were thought of as simple layouts powered by existing solid-propellant rockets. But the available rockets were not powerful enough, and the designers turned to liquid-propellant rockets for the necessary thrust.

This was their big mistake. What had started as a simple test vehicle with construction lasting only for a matter of weeks turned into a complete scaled-down model airplane, requiring months of design and construction time, complexity in the preparation for a test flight, and the simultaneous availability of at least two aircraft plus test equipment and radar plotting stations.

In final form, the test vehicles were 0.3-scale models of the Miles project, without the annular air intake proposed for feeding the turbojets of the full-scale airplane. The fuselage was stressed-skin, with machined nose and tailcone sections. Wing and tail surfaces were wood, with metal inserts.

▶**Model Description**—Span of the test vehicles was 8.07 ft. and overall length was 10.99 ft., not including the pitot tube. Gross wing area was 12.75 sq. ft.

FIRST-STAGE DESIGN of 0.3 scale rocket-propelled model for transonic research.

Weight at the start of burning was 937 lb., and at burnout was 633 lb.

Airfoil section was biconvex, with a 7.5% thickness ratio at the root tapering to 4% at the tip. Body diameter was 1.5 ft.

Three complete test vehicles were built, but during the rocket motor development program, five fuselage-only models were built and dropped from high altitudes.

▶**Data Gathered**—Six-channel telemetering equipment was built into the models to measure and transmit horizontal tail angle, combustion-chamber pressure, static pressure, dynamic pressure, vertical and horizontal accelerations.

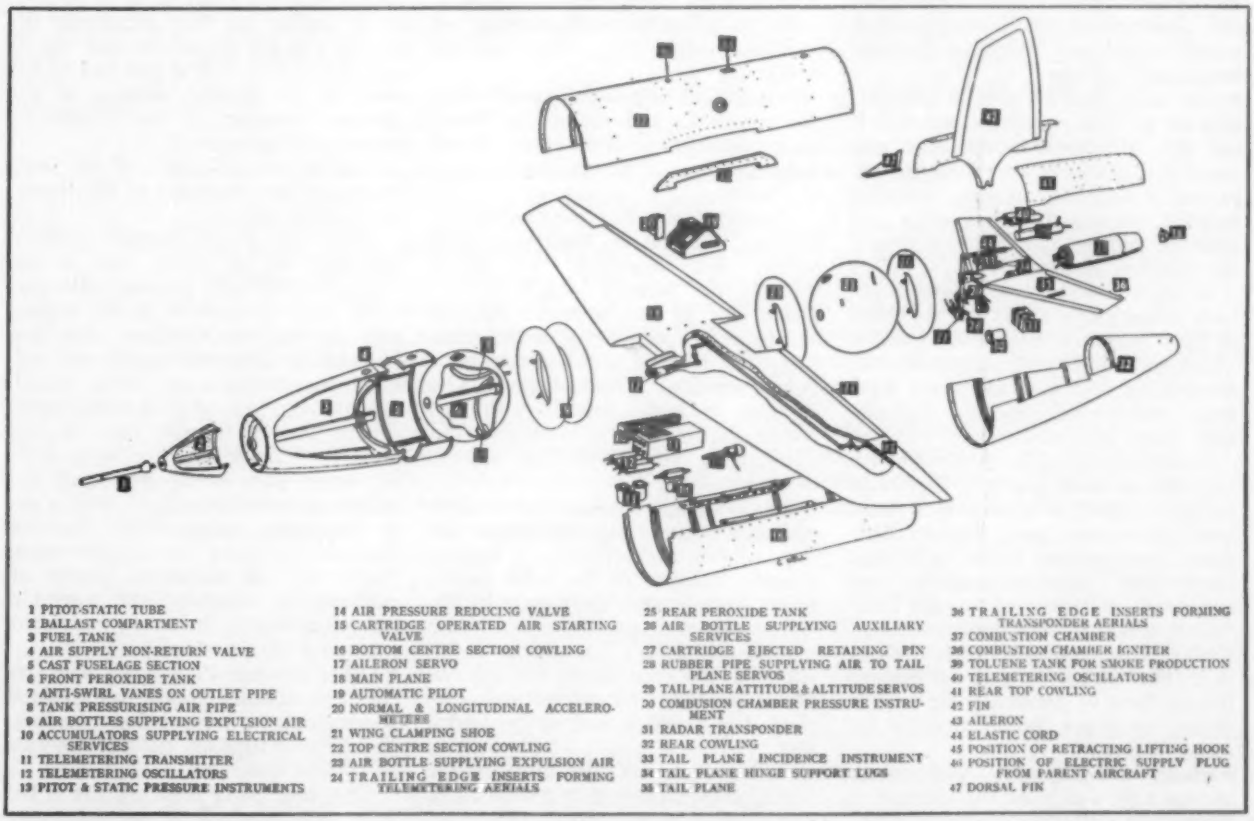
These basic measurements, together with radar plotting data, were to furnish the necessary aerodynamic data.

But the radar failed to track the test vehicle; it locked onto the parent aircraft—a de Havilland wooden-structure Mosquito—and missed the model.

Thrust, drag, airspeeds, pressure data and longitudinal trim curves were plotted either from the measured data or from a combination of measured and computed data, or deduced from wind-tunnel and other measurements.

But there was little information of real value. Points were too few from one test flight to get general data, and breakdown of drag was not possible.

Further, the decision to abandon the



1 PITOT-STATIC TUBE
2 BALLAST COMPARTMENT
3 FUEL TANK
4 AIR SUPPLY NON-RETURN VALVE
5 CAST FUSELAGE SECTION
6 FRONT PEROXIDE TANK
7 ANTI-SWIRL VANES ON OUTLET PIPE
8 TANK PRESSURISING AIR PIPE
9 AIR BOTTLES SUPPLYING EXPULSION AIR
10 ACCUMULATORS SUPPLYING ELECTRICAL SERVICES
11 TELEMETERING TRANSMITTER
12 TELEMETERING OSCILLATORS
13 PITOT & STATIC PRESSURE INSTRUMENTS
14 AIR PRESSURE REDUCING VALVE
15 CARTRIDGE OPERATED AIR STARTING VALVE
16 BOTTOM CENTRE SECTION COWLING
17 AILERON SERVO
18 MAIN PLANE
19 AUTOMATIC PILOT
20 NORMAL & LONGITUDINAL ACCELEROMETERS
21 WING CLAMPING SHOE
22 TOP CENTRE SECTION COWLING
23 AIR BOTTLE SUPPLYING EXPULSION AIR
24 TRAILING EDGE INSERTS FORMING TELEMETERING AERIALS
25 REAR PEROXIDE TANK
26 AIR BOTTLE SUPPLYING AUXILIARY SERVICES
27 CARTRIDGE EJECTED RETAINING PIN
28 RUBBER PIPE SUPPLYING AIR TO TAIL PLANE SERVOS
29 TAIL PLANE ATTITUDE & ALTITUDE SERVOS
30 COMBUSION CHAMBER PRESSURE INSTRUMENT
31 RADAR TRANSPONDER
32 REAR COWLING
33 TAIL PLANE INCIDENCE INSTRUMENT
34 TAIL PLANE HINGE SUPPORT LUGS
35 TAIL PLANE
36 TRAILING EDGE INSERTS FORMING TRANSPONDER AERIALS
37 COMBUSTION CHAMBER
38 COMBUSTION CHAMBER IGNITER
39 TOLUENE TANK FOR SMOKE PRODUCTION
40 TELEMETERING OSCILLATORS
41 REAR TOP COWLING
42 FIN
43 AILERON
44 ELASTIC CORD
45 POSITION OF RETRACTING LIFTING HOOK
46 POSITION OF ELECTRIC SUPPLY PLUG FROM PARENT AIRCRAFT
47 DORSAL FIN

RAE-VICKERS TRANSONIC MODEL is detailed in exploded drawing of major components which also shows recording devices carried.

FOR HIGHER FOR HIGHER FOR HIGHER

Test Vehicle Chronology

MODEL	TYPE	DETAILS
A1	Complete	Lost in cloud during early trials — May 30, 1947.
A2	Complete	First release—rocket motor failed to ignite—Oct. 8, 1947.
A9	Fuselage	Motor-starting tests; released from 35,000 ft. and showed evidence of ignition—Feb. 29, 1948.
A8	Fuselage	Motor-starting tests; released from 35,000 ft., but no evidence of ignition—Mar. 5, 1948.
A12	Fuselage	Motor-starting tests; released from 25,000 ft., and showed successful ignition—June 7, 1948.
A11	Fuselage	Motor-starting tests; released from 35,000 ft., but there was an explosion in the tail section—June 9, 1948.
A10	Fuselage	Motor-starting tests; released from 35,000 ft. with torch igniter, showed successful ignition—Oct. 2, 1948.
A3	Complete	Second release; successful flight—Oct. 9, 1948.

project had already been taken, speeded by the news of the Bell X-1 flight, and the development of better pilotless model techniques, based on ground-launching methods.

▶**The Long, Sad Story**—The specification for the Miles project shows that it was the 24th experimental type proposed for 1943. It was rather an advanced scheme for its day, featuring turbojet propulsion, all-movable tail surfaces, and an annular inlet around the pilot's compartment.

When the design was proposed, nobody knew much about the problems of flight at or near the speed of sound. There were plenty of suggestions for research to find out: highspeed track tests, rocket-missile models, high-altitude drops of special shapes.

Gradually the engineers accumulated little bits of data; gradually they came to believe that the Miles project would never get to sonic speed. Besides, high-speed airplanes were beginning to have longitudinal stability troubles, and windtunnel tests showed that the Miles craft would experience the same things.

Should they continue with the project? They decided to find out through the medium of pilotless scale models, driven by rocket motors through the speed of sound.

▶**Model Development**—Vickers-Armstrongs Ltd. was given the contract to design and build the models in 1945. They started building around existing solid-propellant rockets, but soon found there was not enough power without going to a complicated grouping of rockets connected to a single exhaust nozzle.

Several useless months passed while the boys in the back rooms were trying to get enough total impulse (thrust times duration of thrust) from a pair of rockets.

Meantime, the first information on German activities in liquid-propellant rockets was beginning to trickle through the security veil, and this looked like an easy solution. Alcohol and hydrogen peroxide were chosen as the basis for the development of a liquid-propellant rocket engine. The duration of flight possible with this system meant that an autopilot and telemetering equipment had become necessities.

▶**Detail Design**—Rocket motor, autopilot and telemetering gear became the responsibility of the Ministry of Supply. Progress was slow; on the rocket motor, delays were because there were so few technicians with any experience whatever in that field. The fuselage design situation was even worse; the internal layout depended on engine and autopilot details which had to be settled first.

Still another difficulty arose on the Miles project; there didn't seem to be any solution to the bailout emergency escape problem. Further, as knowledge of sonic-speed flight increased, so apparently did the difficulties of that kind of flight. There seemed only one way out, and in 1946 the contract for the Miles project was canceled.

Design of the models continued, but instead of going ahead with the improved configuration of the Miles E.24/43, the decision was made to use 0.3 scale models of the early full-scale design.

▶**The Model**—Location of the center of gravity and the desire to keep it there during flight restricted the internal layout of the vehicle. By the time everything was fitted into place, the fuselage was chock-full. As the RAE report says, "...a descriptive verb is 'squeezed'."

One unusual design stunt resulted in the use of toroidal pressure vessels for the high-pressure air used to force propellants into the rocket engine. These could be fitted at either end of the spherical tanks used to contain the propellants, minimizing the space allotment in the fuselage. Such toroidal vessels are in use on at least one contemporary U. S. guided missle today, where they show great advantage over the spherical or cylindrical types in efficient packaging.

The autopilot was modified from a unit used in the German V-1 buzz-bomb, tailored to suit the job. It was an air-driven unit, designed for low altitudes, but the use on the Vickers models required functioning at 35,000 ft. It turned out that adjustment of the air jets for gyro drive and signal pickoff was very critical and had to be done by an operator working in an altitude chamber at the 35,000-ft. pressure altitude.

Some of the difficulties of the final layout are best expressed in the words of the RAE report:

"The test vehicle consumed large quantities of air which had to be transported at high pressure, released, dried, then pressed to a still higher pressure; was very fastidious regarding fuels which, being bad neighbours, had to be transported separately in special road tankers, to be tended daily during storage and be handled only in the presence of ample quantities of protecting water (also transported); and required attendants equipped with a selection of contortionist spanners [wrenches], long round-the-corner fingers and an unlimited supply of patience to surmount the assembly difficulties arising from the congested nature of its construction."

▶**Other Services**—Preliminary work on the test vehicles meant using three windtunnels, a refrigeration chamber, an altitude chamber, and a temporary rocket test site.

The tests were done at the Scilly Isles (off Cornwall at the southwest corner of England) where there had

been a wartime radar station with serviceable GCI equipment. This location

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been a wartime radar station with serviceable GCI equipment. This location was remote enough to run the tests, and close enough to an RAF station to have available the mother aircraft and any other search, warning or rescue planes.

Logistics was a problem; everything used for the tests, including fuel and water used in the event of fuel spillage, had to be transported to the site.

A Mosquito XVIB was modified for the carrier airplane; its bomb-bay doors were slotted to take the vertical tail of the research models, which were slung externally.

One of the problems was guaranteeing ejection of the vehicle if the crew had to abandon the plane, or if any trouble developed in the model. Four means of release were designed and used simultaneously and the suspension systems were calculated to fail at 4.5G in tension

▶ **First Tests**—During early flight checks of the telemetering system, the Mosquito got into some cumulo-nimbus and was thrown out of control. It dropped from 22,000 ft. to 8,000 ft. during which time the crew decided to abandon the ship and jettisoned the escape hatch. The Mosquito fell out of the bottom of the storm and control was regained; but somewhere in the mess, the lug had failed. The test vehicle, complete with all the prototype equipment, plunged into the Bristol Channel.

The second complete model fared no better. As it was loaded aboard the Mosquito for test flight, somebody saw peroxide dripping out of the burner. An inspection showed that a burst-diaphragm had ruptured and was leaking. Under hazardous conditions, the diaphragm was replaced, and the vehicle again made ready for flight.

Drop appeared normal from altitude, but after about 20 sec., there was an explosion which destroyed the model. However, salvage attempts proved to be fruitless.

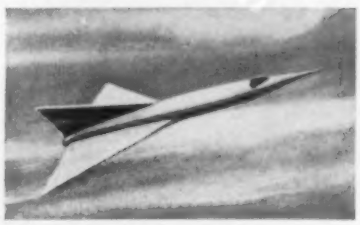
Then came a year's delay while the motor performance was investigated. Some fuselage models were built and dropped to check high-altitude ignition of the rocket motor. The troubles were traced to this, and a torch igniter had to be developed to guarantee that the fuels would ignite under the low temperature and pressure in the combustion chamber of the rocket motor at the release altitude.

▶ **Final Test**—Model A3, the last complete unit to be tested, was ready Oct. 9, 1948. The Mosquito took off and climbed to 35,500 ft. for release. It leveled off, accelerated to a steady flight speed of just under Mach 0.5, and released the test vehicle.

For six seconds it fell away from the mother ship; then the rocket motor

experience

plays a vital role in every success



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blasted its raucous noise into the thin air. The little model accelerated smoothly, straight-and-level, for almost a minute, reaching a maximum speed of Mach 1.38.

The dive signal came at the right time, but the tail deflection was not great enough to dive the vehicle steeply into the sea. Instead it continued on a westerly course, going out of GCI range at about 60 mi., seven minutes after release. Telemetering signals came in for eight minutes more, then ceased abruptly. There is no evidence of how far the research model flew before it splashed.

▶ **They Learned**—There was more gained from the experiments than incomplete aerodynamic data.

The biggest lesson was the experience and know-how gained in flying pilotless aircraft, but this was largely thrown away when the British stopped test program.

The difficulties had been surmounted, because the final flight of model A3 was successful in every respect. But it only "accentuated the cumbersome and uneconomic nature of the technique in which months of effort were required for an active vehicle life of only 100 sec."

The rocket engine people learned the hard way about high-altitude ignition problems, and they learned a lot about handling hydrogen peroxide.

The telemetering people learned that low temperatures and long flight paths caused frequency drifts, messing up the telemetered data.

But that was a small return on the investment, and viewed alone, justified closing out the project.

But back there in 1948, somebody should have taken a long, hard look at the whole program, not just as a means to get data for a lost cause, but as a method of getting transonic data which —apparently— is still either missing or unused by British designers.

This was the biggest lesson of the RAE-Vickers experiments, and the one that was not learned.—DAA.

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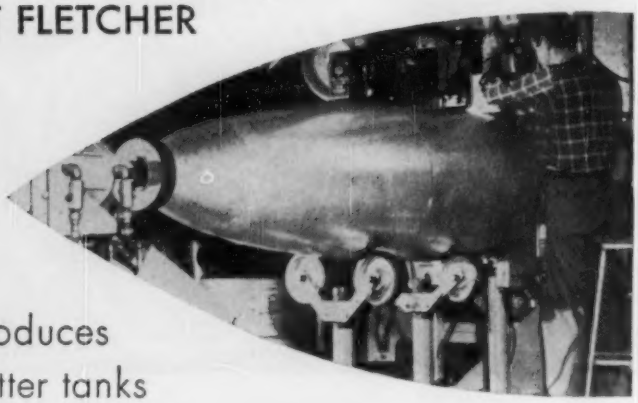

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Loewy-Hydropress Sold for $2 Million

Marking its continued diversification, Baldwin-Lima-Hamilton extended its activities into aviation by acquiring the Erwin Loewy Hydropress interests, which have been engaged in designing and building heavy presses. Price: About $2 million, according to reliable sources.

Baldwin-Lima-Hamilton now has 100% ownership in both Hydropress, Inc., and its wholly owned subsidiary, Loewy Construction Co., Inc. Erwin Loewy remains president of both of his former enterprises, according to the announcement, and organization of the companies remains unchanged. Baldwin-Lima-Hamilton's other interests include electronics, manufacture of locomotives, earth-moving machines, heavy machine tools and marine engines.

Plastic Hammers Save Douglas Money

Use of plastic hammers for metal forming in place of fiber, lead and rawhide units is expected to save $1,391 monthly at Douglas Aircraft Co.'s Long Beach division, the company says.

Douglas has switched to Nupla hammers, trade name for a tool made by New Plastics Corp., Los Angeles. Previously, the Long Beach division reports, it required 1,333 replacement units monthly, averaging $1.10 each. The Nuplas are expected to cut this rate to about 50 units, each costing $1.39. The plant has 10,000 employes using hammers in metal forming operations on the production lines.

The hammers are available in 13 weights and can be equipped with faces ranging from "softer-than-rubber" to "harder-than-rawhide." Workers can carry extra tips in their pockets for quick replacement.

TIMKEN® wheel bearings stand up every time this 92½-ton airplane lands

ONLY the very best parts and material went into this new B-47 jet bomber. Nothing else could stand the strains of high-speed flight and landing. Most landings of the 92½-ton Stratojet are light as a feather but occasionally even the most proficient pilot sets one of the sleek airplanes down with a wallop! Why aren't there breakdowns? Because B. F. Goodrich Company engineers mounted the wheels on Timken® tapered roller bearings.

One reason Timken bearings can take shock loads like this is because their rollers and races are case-hardened. This process gives Timken bearings hard, wear-resistant surfaces over tough, shock-resistant cores. Another reason is that Timken bearings have full line contact between rollers and races resulting in load-carrying capacity to spare.

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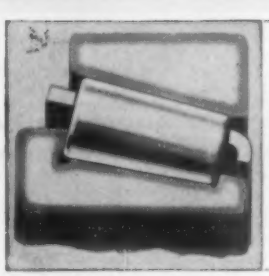

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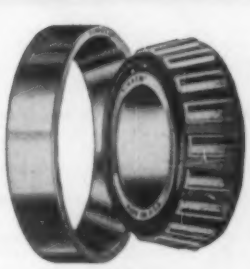

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IAS Honors Eight Aeronautics Leaders

Institute of the Aeronautical Sciences has announced the election of eight members of the U. S. and British aviation industries as IAS fellows, awarded for reaching positions of distinction in aeronautics plus notable and valuable contributions.

Two new honorary fellows are Maj. Lester D. Gardner, who established AVIATION WEEK's predecessor, *Aviation*, in 1916, organized IAS in 1932 and headed the Institute until he retired in 1946; and Sir Richard V. Southwell, British pioneer in aerodynamic research.

The six new fellows:

- **Robert T. Jones,** aeronautical research scientist at Ames Aeronautical Laboratory, National Advisory Committee for Aeronautics.
- **Dr. William P. Jones,** superintendent of the Aerodynamics Division of Britain's National Physical Laboratory.
- **Brig. Gen. Benjamin S. Kelsey,** deputy director of USAF's research and development office.
- **Richard V. Rhode,** NACA's assistant director for research in aircraft construction.
- **Edgar Schmued,** vice president-engineering of Northrop Aircraft, Inc.
- **Adm. John H. Towers** (USN Ret.), president of the Flight Safety Foundation.

Navy Contracts

Contracts recently announced by the Navy's Aviation Supply Office, 700 Robbins Ave., Philadelphia 11, are:

Chicago Aerial Survey Co., 1980 Hawthorne Ave., Melrose Park, Ill., services and material to overhaul photographic equipment, $72,070.

R. E. Darling Co., Inc., 6825 Reed St., Bethesda 14, Md., disconnects, $34,938.

Goodyear Tire and Rubber Co., Inc., 1144 E. Market St., Akron 16, brake assy. linings, 115,872 ea., $75,085.

Gould-National Batteries, Inc., 35 Neoga St., Depew, N. Y., batteries, $67,633.

Grimes Mfg. Co., 515 N. Russell St., Urbana, Ohio, parts for use in lighting aircraft instruments, $60,591.

Hydro-Aire, Inc., 3000 Winona Ave., Burbank, Calif., maintenance parts used on filters and valves, $40,129.

Interstate Forging and Supply Corp., White House Lane, P. O. Box 536, Highspire, Pa., cargo hooks, rigging plates and swivels, 1,000 ea., $38,800.

Monsanto Chemical Co., Plastics Div., P. O. Box 1531, Springfield 2, Mass., polyvinyl butyral resin, 26,000 lb., $37,440.

Pervo Paint Co., 6624 Stanford Ave., Los Angeles 1, exterior paint, 24,900 gal., $41,412.

Vickers, Inc., 1400 Oakman Blvd., Detroit 32, valve assys., 447 ea., $256,446.

Wm. R. Whittaker Co., Ltd., 915 No. Citrus Ave., Los Angeles 38, valves, 130 ea., $53,714.

Aero Supply Mfg. Co., Inc., 611 W. Main St., Corry, Pa., maintenance parts used on valves for various aircraft, $56,921.

Aero Tube Co., P. O. Box 310, Gowanda, N. Y., tube assys., $47,722.

Boston Insulated Wire and Cable Co., 65 Bay St., Boston 25, wires, $46,555.

Andrew Brown Co. of Maryland, Inc., 801 Lee St., Irving, Tex., lacquer, $41,216.

Champion Spark Plug Co., 900 Upton Ave., Toledo 1, spark plugs, $64,996.

Cleveland Pneumatic Tool Co., 3781 E. 77th St., Cleveland 5, actuators, $69,001.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., instruments for various aircraft, $31,356.

General Laboratory Associates, Inc., 17 East Railroad St., Norwich, N. Y., services and material to overhaul exciter assys., $56,308.

Goodyear Tire and Rubber Co., Inc., 1144 E. Market St., Akron 16, rotating disks, 4,780 ea., $26,811.

Lear, Inc., 110 Ionia Ave., N. W., Grand Rapids, Mich., amplifiers, brackets and drum capstan assys., $148,848.

Red Bank Div., Bendix Aviation Corp., Eatontown, N. J., generators, 79 ea., $40,606.

Roanwell Corp., 62 Pacific St., Brooklyn 17, N. Y., microphone assys., $64,495.

Telephonics Corp., Park Ave., Huntington, L. I., N. Y., microphone assys., $55,068.

Thompson Products, Inc., 23555 Euclid Ave., Cleveland 17, fuel pump assys., 755 ea., $242,133.

Vickers, Inc., 1400 Oakman Blvd., Detroit 32, pump and motors, $297,604.

Bendix Radio, Bendix Aviation Corp., E. Joppa Rd., Towson 4, Md., switch drive subassys., $32,900.

Douglas Aircraft Co., Inc., 827 Lapham St., El Segundo, Calif., wing assys., $452,193.

B. F. Goodrich Co., 500 S. Main St., Akron 18, maintenance parts used on brake and wheel assys., $32,725.

Goodyear Tire and Rubber Co., Inc., 1144 E. Market St., Akron 16, brake linings, 33,552 ea., $42,309.

Pangborn Corp., Hagerstown, Md., grit, decomposed rock, $25,114.

Scintilla Div., Bendix Aviation Corp., Sherman Ave., Sidney, N. Y., distributor and magneto assys., $83,992.

Taylor, Lovenstein and Co., 56 N. Commerce St., Mobile, Ala., turpentine, $25,056.

Turco Products, Inc., 95 Fairmount Ave., Philadelphia, cleaning compound, $38,369.

Aviation Week Picture Brief

HYDRO-SKI-EQUIPPED SNJ-5C skims over Patuxent River, Md., on a test.

SNJ Is Hydro-Ski 'Guinea Pig'

While the spotlight has centered on the spectacular hydro-ski-equipped delta Convair XF2Y-1 Sea Dart fighter, Navy has been compiling data on this interesting landing gear, using as a test vehicle a specially modified North American SNJ-5C Texan.

Private firms working on hydro-ski programs, using their own testbeds, include Edo Corp., N. Y., and All American Aviation, Wilmington, Del.

The SNJ is pictured fitted with dual skis; the single-ski layout is another version of the gear.

In addition to carrying two large streamlined tanks under its wings near the fuselage for emergency flotation, the SNJ also had its wings coated with Neoprene for additional buoyancy. These features proved handy when the plane nearly dunked during tests at heavy loads.

SNJ tests have been the responsibility of the Patrol Branch, Naval Air Test Center, Patuxent River, Md.

UP THE RAMP comes the Texan. Note flotation tanks under the wings.

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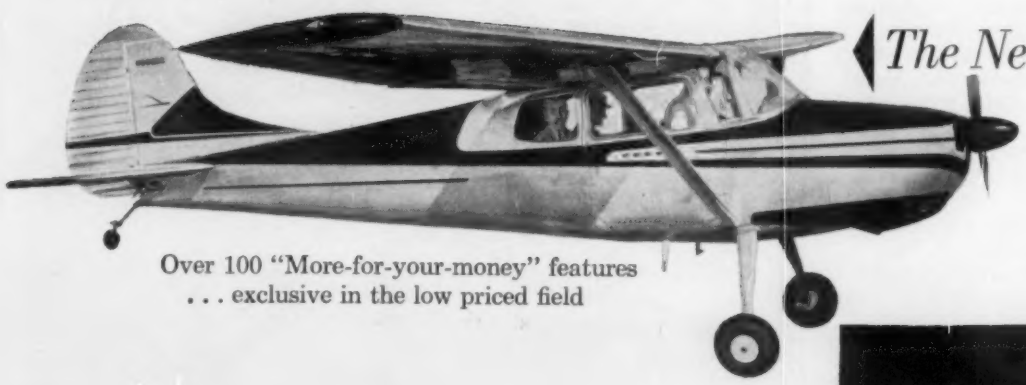

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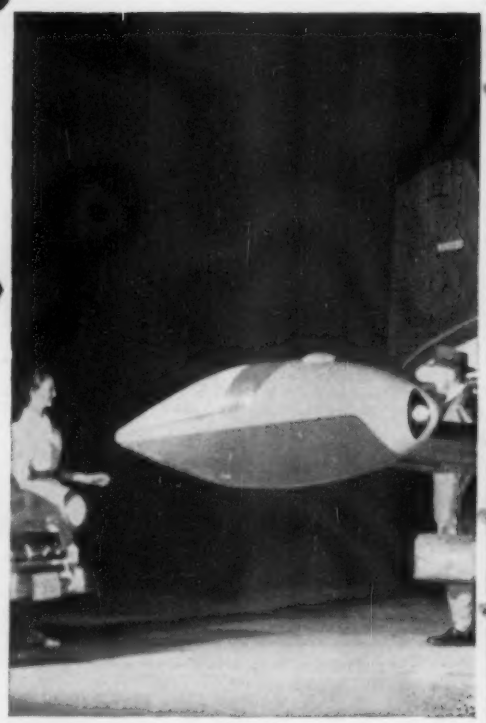
The All-New Cessna 310



Again Cessna's production skill gives you far more airplane for your money . . . this time in a brand new, all new "twin" that's years ahead in design and performance. It's the newest and fastest of the new twins . . . the cleanest aero-dynamically—with wing-tip gas tanks, retractable landing gear, flat engine nacelles, "Jet"-type tail! It's the ultimate in private or business transportation. On *one* engine—fully loaded—it climbs 380 feet a minute. And in it you can travel comfortably over 1,640 miles in a single 8-hour day. Yet the price is surprisingly low for an airplane of this caliber—$49,950 f. o. b. Wichita.

For more information, see your nearest Cessna dealer (listed in yellow pages of phone book) or write CESSNA AIRCRAFT CO., DEPT. AW-1, WICHITA, KANSAS.

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PRODUCTION BRIEFING

▶ **Magseal, a new impregnating process** to reduce magnesium's susceptability to corrosion, has been developed by Nu-Line Plastic Impregnating Co., Los Angeles. Magseal is a resin combination, polymerized into the metal after parts are rinsed in an alkaline-type cleaning solution. Firm notes that impregnated magnesium samples showed no evidence of pitting or failure after being subjected to 125-hr. continuous salt spray.

▶ **Industrial Liaison Office** of Middletown Air Materiel Area is now located at USAF New York Air Procurement District, 111 E. 16th St., New York 3, N. Y. Phone is Spring 7-4200, Ext. 689. The ILO is designed to aid USAF prime contractors, subcontractors and suppliers on industrial relations matters.

▶ **Turbine blade inspection time** has been cut from eight hours to five minutes at Boeing-Seattle, using checking devices developed by Fred Fuller, Boeing tooling engineer. Up to 150 blades may be checked hourly to 0.0005 in. Check gages have up to 13 metal "fingers" mounted on springs and extending from the open end of a cylinder. To

operate, a master turbine blade is inserted in the gage. Movement of a lever brings all of the fingers against the blade at various points. Fingers are connected to linkages which operate dial indicator needles. When successive blades are placed in the gage, indicator dial needles will show any variation from master dimensions.

▶ **Miller Metal Products, Inc.,** Baltimore, has renamed its Engineering Research Division the Miller Research Laboratories. MRL will continue weapons research, development and production engineering.

▶ **Republic Manufacturing Co.,** Cleveland, maker of aircraft and industrial valves, has moved to new headquarters at 15655 Brookpark Rd., Cleveland 11.

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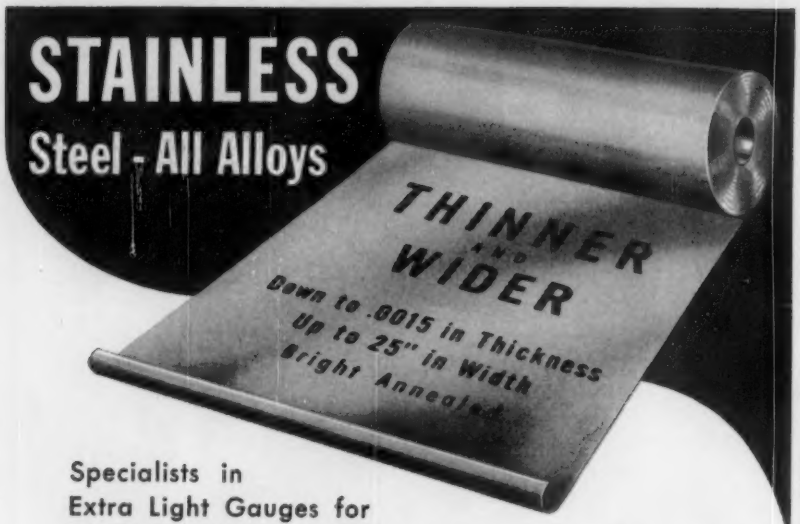

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THERMODYNAMICIST

Conduct analysis of internal airflow systems, establish optimum design for power plant installations in advanced models. Calculate and reduce basic data and flight test results to establish engine performance and complete speed and altitude range. ME or AE plus 4 years minimum aircraft or related power plant experience.

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NORTH AMERICAN AVIATION
Columbus 16, Ohio

Firm has appointed these new distributors: Power Transmission Co., South Bend, Ind.; Air Engineering & Supply Co., Minneapolis; Leinart Engineering Co., Atlanta; Flow Engineering & Sales Co., Birmingham, Ala.

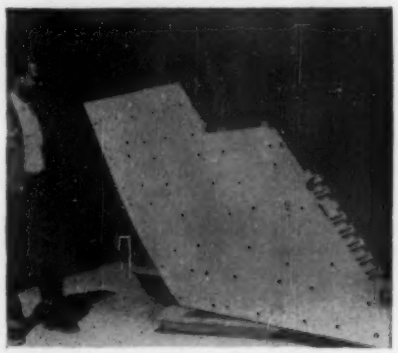
▶ **Clark Equipment Co.'s** mobile service school has completed its first year of traveling, during which it visited 43 cities and instructed more than 4,000 fork truck operators and maintenance personnel from about 1,500 firms.

▶ **Shell Oil Co.** will be exclusive supplier of piston-engine oil to Pratt & Whitney Aircraft Division for 1955, the oil company reports. Product is AeroShell Oil 100. Shell will also supply half of P&W's JP-4 needs. Contracts exceed $2 million.

▶ **L. B. Smith Aircraft Corp.**, Miami, Fla., business aircraft modification and conversion center, has signed an agreement with Butler-Zimmerman, Inc., New York, industrial designers, granting Smith the exclusive services of B-Z on business plane interiors.

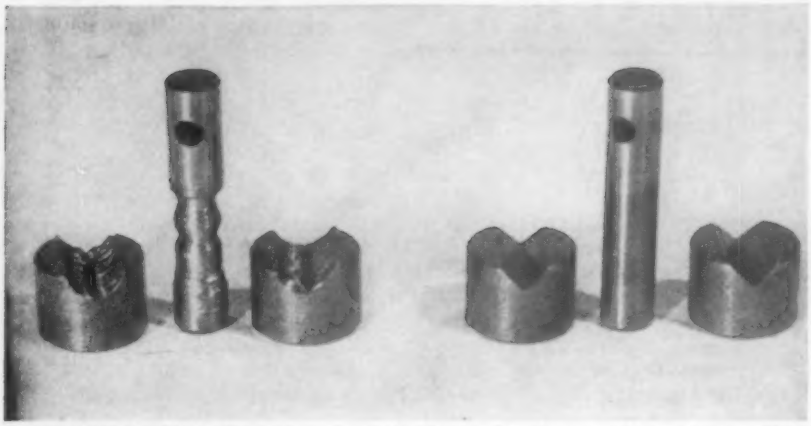
▶ **American SIP Corp.**, New York, U. S. distributors of SIP jig borers and precision measuring equipment, has appointed Overgard Machine Tool Co., Denver, as its representative serving Colorado and Utah.

▶ **Cooper Alloy Corp.**, in joint sponsorship with Navy BuAer, has broken ground on a new plant to make jet engine rings and other components. The Clark, N. J., facility, to have 26,000 sq. ft. area; will be operated by Cooper's Aircraft Products Division.



Missile Gets New Wing

Outer wing panel for the Chance Vought Regulus surface-to-surface missile, when cast from magnesium is more economical and lighter than conventionally built units, the airframe maker reports. Here is a cast magnesium panel forming the section outboard of the missile's wing fold, as made by Osbrink Mfg. Co., Los Angeles, Calif. It weighs 162 lb. and has relatively few fasteners compared with conventionally built-up panel weighing 229 lb.



WORN SPECIMENS (left) used commercial silicone lubricant, others used new fluids.

New Silicone Lube Passes Jet Tests

Exceptional thermal and load-carrying properties characterize a new silicone lubricant developed by Westinghouse Electric Corp. scientists specifically for aircraft gas turbine use.

The lubricant has been tested on all lube points of a standard Westinghouse jet engine and last spring was cleared for engine operations. It ran in a turbojet for a 15-hr. test period, and when the engine was torn down at the end of that time, there was no sign of trouble and no sludge.

Further testing is being done by the military with quantities of the new fluid supplied by Dow Corning Co., manufacturer of the lubricant.

▶ **Why Silicones?**—At first glance, the silicones look ideal for lubricants. They have high thermal stability; the viscosity-temperature relationship is favorable. They resist oxidation, have a high flash point, pour and freeze at low temperatures.

But they don't lubricate steel surfaces very well.

George Townsend, a Westinghouse engineer in the Aircraft Gas Turbine division, was looking into the lubrication problem for jet engines. Gears and bearings run hot and at high pressures; the Sundstrand drive has its own tough lubrication setup. When a turboprop comes into the picture, its gear train is, according to Townsend, ". . . the worst, right across the board."

Besides lubricating, the oil or fluid is called upon to remove large quantities of heat from bearings, so that it has to be a decent heat transfer medium as well.

Silicones looked good to Townsend, except for the fact that they wouldn't lubricate. He compiled a list of the necessary properties an ideal silicone would have, and hopefully packed the list off to Dr. Gordon C. Gainer, who supervises chemical development for the Westinghouse Materials Engineering Department.

▶ **Modified Molecule**—Gainer reasoned that the silicone oil was not adsorbed enough by the steel surfaces to form a packed, thin layer of lubricant. His solution was to alter the molecular structure of the silicone to produce new groups which would force a chemical reaction at the steel surface.

Both Gainer and Townsend tested the new fluid with standard machines. On the Shell four-ball unit they were able to reach bearing pressures as high as 107,000 psi. before the metal parts seized. This bearing pressure is from four to eight times as great as current permissible limits.

Development is continuing, but in its present state the fluid has about the same load-carrying ability of the diester fluids qualified against MIL-L-7808 specification, but considerably better thermal stability. Viscosity-temperature characteristics are better than MIL-O-6081 Grade 1010.

Thermal stability trials and viscometric tests made with the fluid ranged from −65 deg. F to 500 deg. F.

"In short," says Townsend, "we get better load-carrying capacity at high temperatures without any sacrifice at the low-temperature end."

Jet Fuel Controls Need Better Filters

Emphasis on development of specific test procedures to measure performance of jet fuel filters for use in future Navy specifications is the subject of a second Navy research and development contract given Detroit Testing Laboratory, Inc., 548 Bagley Ave., Mich.

Initial contract handled by the firm covered the nature, extent and effects of contamination fuel system components, and preliminary studies of methods of measuring functioning of filters. It was found that filters expected to stop all dirt over 10 microns were passing particles up to 70 microns, according to the firm.

Problems of premature failure in service of engine fuel control units have prompted the Navy studies, Detroit Testing states. Fuel supply control mechanisms used to meter thousands of pounds of fuel per hour into a turbojet are far more complex than those required by piston engines. These complex mechanisms have such fine clearances that a few parts per million of dirt in the fuel eventually cause failure.

Mount Isolates Copter Vibrations

All-metal equipment-mounting vibration isolation system, Model 1355-1, for helicopters has a resilient center coinciding with the equipment's center of gravity, resulting in decoupling all modes of vibration and there being only one natural frequency present in each of the three principal directions.

Vibration is isolated from 9 cps. and up. The mount may be tilted to 45 deg. about the transverse axis without performance changing appreciably, the maker notes.

Robinson Aviation, Inc., Airborne Division, Teterboro, N. J.

BuAer Contracts

The following contract awards of $25,000 and more have been announced recently by the Bureau of Aeronautics, Department of the Navy, Washington 25, D. C.

AEROJET-GENERAL CORP., Azusa, Calif., booster motors with contractor-furnished chambers, 100 ea., $97,483.

AIR PRODUCTS, INC., Allentown, Pa., design, fabricate and install oxygen equipment, $33,995.

AIRESEARCH MFG. CO., Los Angeles 45, dual-purpose auxiliary powerplants, 4 ea., $226,890.

APPLIED SCIENCE CORP. of PRINCETON, Princeton, N. J., monitor stations and components, 5 ea., $90,179.

BENDIX AVIATION CORP., Teterboro, N. J., fabricate and furnish a three-gyro stable platform, 1 ea., $35,000.

CURTISS-WRIGHT CORP., Caldwell, N. J., overhaul and maintenance of government-owned propellers, 2 ea., $71,194.

DOUGLAS AIRCRAFT CO., INC., Santa Monica, Calif., rocket launchers, 15 ea., $74,410.

GENERAL ELECTRIC CO., Schenectady, N. Y., instrument test equipment, drawings and instructions, 80 ea., $128,150.

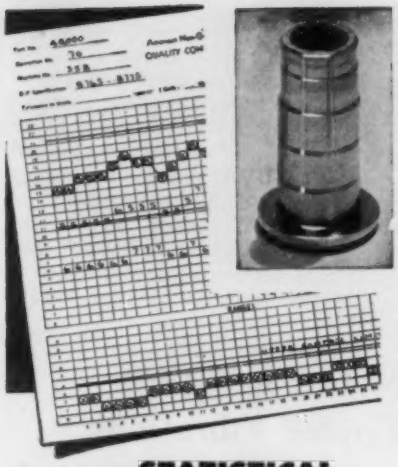
McCULLOCH MOTORS CORP., Los Angeles 45, services of two factory trained field technicians, $33,200.

RAYMOND ROSEN ENG. PRODUCTS, INC., Philadelphia 4, install modification kits in synchronizers, 55 ea., $42,000.

STEWART-WARNER CORP., Stewart-Warner Elec. Div., Chicago 51, field engineering services, 60-man months, $61,331.

SUNDSTRAND MACHINE TOOL CO., Sundstrand Aviation Div., Rockford, Ill., acquisition, rehabilitation and installation of machine tools, etc., for production of aircraft constant-speed drives, $5,077,030.

WESTERN ELECTRO-CHEMICAL CO., Culver City, Calif., develop, install and operate an electrolytic cell, $143,835.



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WHAT'S NEW

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Users of airfreight are offered a 20-page booklet, **Industry's Flying Partner,** which details how to ship by air, what can be shipped, how much it costs, plus descriptions of air express, airmail and air parcel post. Copies can be obtained at United Air Lines' sales and air cargo offices. . . . **Technique of spraying cocoon plastic** protective coatings is explained in manual available from Industrial Division, R. M. Hollingshead Corp., 840 Cooper St., Camden 2, N. J.

Profusely illustrated 84-page booklet providing **case histories in pictures of stretch-wrap forming machines** at work in scores of applications is available from Hufford Machine Works, Inc., El Segundo, Calif. . . . **Facilities for producing precision forgings** to customers' specs are shown in 20-page brochure being distributed by Consolidated Industries, Inc., West Cheshire, Conn. Sections are also devoted to nomenclature, design layout, die design, tolerance tables and other information for designers.

Permanent magnet direct current motors with outputs up to $\frac{1}{4}$ hp. are detailed in Catalog F 4344-1, available from Barber-Colman Co., Rockford, Ill. . . . **Sub-miniature pilot lights** of the one-terminal type for use on grounded circuits are covered in Brochure L-157. Lights require $\frac{11}{32}$-in. clearance hole; voltages ranging from 1.3-28 v. Write R. E. Greene, Dialight Corp., 60 Stewart Ave., Brooklyn 37, N. Y.

Latest abrasive engineering recommendations for metal finishing are given in a 42-page booklet, which also gives suggested layout for setup and curing room and gives chapters to metal buffing, metal tumbling and pressure blasting. Available from Carborundum Co., Niagara Falls, N. Y. . . . **Heavy-duty counter sinkers** working up to 1-in. diameter in non-ferrous materials and up to $\frac{3}{8}$-in. diameter in ferrous materials are shown in Bulletin F-104, from Farnham Mfg. Division, Wiesner-Rapp Co., Inc., 1600 Seneca St., Buffalo 10, N. Y. . . . Complete line of **Firlomet cement carbide blanks** and prices and terms are available in Catalog No. 1 from Firth-Loach Metals, Inc., Buttermilk Hollow Rd., McKeesport, Pa.

New 100-page book describes all models of **Mahr precision gear testers** manufactured by Carl Mahr in Germany and handled in this country by George Scherr Co., Inc. Requests for copies should be on letterhead stationery, giving full title. Address: George Scherr Co., Inc., 200 Lafayette St., New York 12. . . . Catalog 54 is 24-page booklet showing complete line and data on **split ballbearings.** Write Split Ballbearing Corp., Lebanon, N. H. . . . Complete new line of **tool room wheels** and hints for conservation of tools, plus chart giving recommendations for grinding highspeed tool and die steels, are contained in "V40 for Tool Room Grinding," available from Carborundum Co., Niagara Falls, N. Y. . . . New set of catalogs describes **electrodes, rods and wires** for ARC, submerged ARC and inert ARC welding. Write to Metal & Thermit Corp., 100 E. 42 St., New York 17.

Catalog on new **USAF Academy** outlines proposed courses of instruction, and requirements and procedures for admission, as well as a few sample questions from Air Force pilot and officer aptitude tests. Address: Air Force Academy, Appointment Branch, AFPTR-5, Hq., USAF, Washington 25, D. C.

Revised edition of **Illinois Airport Directory** is available from Department of Aeronautics, Springfield, Ill.

Tru-Cast handbook is 48-page illustrated publication billed as "the first authoritative and complete guide" to use of beryllium copper pressure-cast cavities and cores. Book is available free of charge to companies in stamping, molding or related activities; price to others is $2.00. Address: Manco Products, P. O. Box 5231, Detroit 35.

Publications Received

• **Fluid Dynamic of Jets**—by Shih-I Pai, Ph.D.—Pub. by D. Van Nostrand Co., Inc., 250 Fourth Ave., N. Y., N. Y. $5.00; 227 pp. Modern developments in fluid dynamics, with particular emphasis on the flow field of jets, for engineers, researchers.

• **Aircraft Recognition Manual,** new and revised edition—by C. H. Gibbs-Smith—Published by Putnam & Son, 42 Great Russell St., W. C. 1. Distributed in the U. S. by John DeGraff, Inc., 64 West 23rd St., N. Y. 10, N. Y. $2.50; 239 pp.

• **A Day in the Life of A Jet Test Pilot**—by the National Aviation Educational Council, Inc., Materials of Instruction Committee, 1115 17th St., N. W., Washington 6, D. C. Single copy, $.50 ea., discounts for classroom use listed on last page; 32 pp. Fourth in a series of Aviation Education Booklets prepared to provide dependable information for young people interested in increasing their knowledge of aviation.

• **Engineering Dynamics, Volume IV, Internal-Combustion Engines**—by C. B. Biezeno and R. Grammel, translated from the original German by M. P. White—Pub. by Blackie & Son Limited, 17 Stanhope St., Glasgow, C. 4. 50s net ($7.00); 282 pp. Continuation of the usual textbooks in which the more difficult problems met in engineering practice cannot be fully covered.

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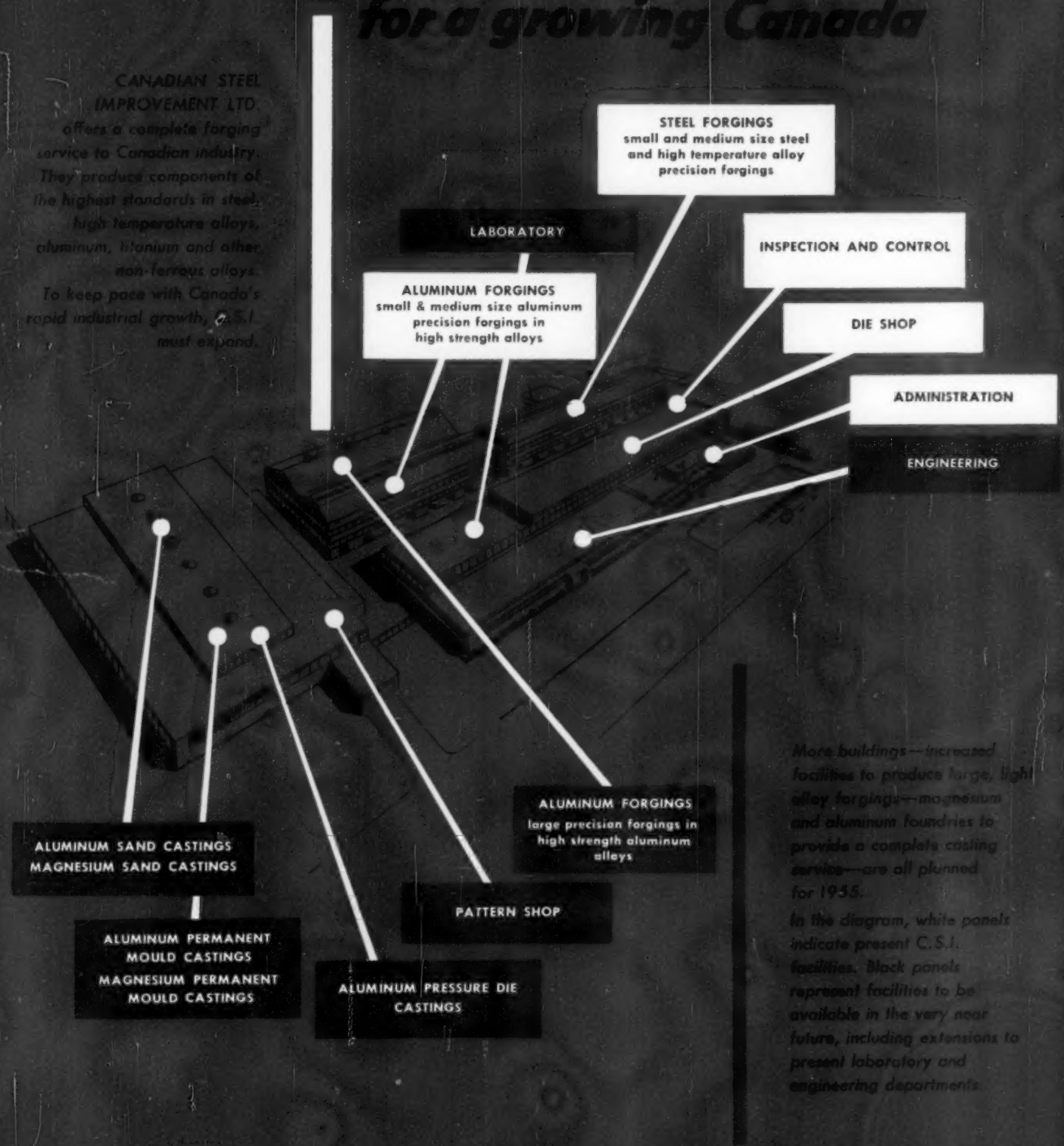

More buildings—increased facilities to produce large, light alloy forgings—magnesium and aluminum foundries to provide a complete casting service—are all planned for 1955.

In the diagram, white panels indicate present C.S.I. facilities. Black panels represent facilities to be available in the very near future, including extensions to present laboratory and engineering departments.

CSI CANADIAN STEEL IMPROVEMENT LIMITED

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FINANCIAL AID TO HIGHER EDUCATION

Business Aid for Our Colleges—Voluntary or Involuntary?

Previous editorials in this series have shown that:

- As a group the nation's independent, privately endowed colleges and universities are in grave financial trouble, and
- There are many different means by which business firms can extend a helping hand to these institutions.

This editorial, one of a series devoted to the financial problems of higher education, submits this proposition: **If business firms do not voluntarily go to the financial aid of higher education, there is every prospect that they will soon be providing more financial support for higher education involuntarily, through taxation.**

If this prospect materializes, one of the basic elements of a well-balanced system of higher education—a strong array of independent colleges and universities—may well be dangerously weakened if not destroyed. And in the process a potentially crucial bulwark for freedom of enterprise in the United States—that same strong array of independent colleges and universities—will be undermined.

Acceptance of these propositions implies absolutely no disparagement of tax-supported colleges and universities. These have an indispensable role in the total system of higher education in the United States. Leaders of these institutions would be among the first to agree that their position is strengthened by a strong system of independent institutions, supported privately rather than by political agencies.

What is the evidence that in one way or another, voluntarily or involuntarily, business will be giving more financial support to higher education? One impressive part of this evidence is provided by the recent rapid increase in the proportion of college and university students attending tax-supported institutions.

Rapid Shift in Enrollment

In the fall of 1952 tax-supported colleges and universities enrolled about 7.5 per cent more students than the independent institutions. In 1953 this percentage was doubled. And in 1954 the tax-supported institutions enrolled 26 per cent more students.

In the case of students entering college for the first time the relative growth of the tax-supported institutions recently has been even more striking. In 1952, the number of beginning students in the tax-supported schools, as reported by the U. S. Office of Education, exceeded those in the independent colleges and universities by 35 per cent. In 1954, just two years later, this figure jumped to 49 per cent.

Why has the proportion of students attending tax-supported colleges and universities been in-

creasing so rapidly? There are many reasons. But a dominant reason is that, in order to keep going at all, the independent institutions have been forced to make large increases in the prices they charge for instruction. The purchasing power of their endowment funds has been cut in half by price inflation. The capacity of the wealthy to supplement their endowments by gifts, as they have done in the past, has been greatly reduced by high taxes. As a result these schools have been forced to rely increasingly on higher prices for instruction (tuition as it is called in academic circles) to make both ends meet.

Since 1940, the independent colleges and universities have raised their tuition fees by an average of about 60 per cent. This is considerably less than the increase of about 100 per cent in prices generally since 1940. And it is nowhere near enough to prevent the faculty members of the independent colleges from faring miserably in terms of salaries, a matter of major national importance to which we shall return in this series. But the increase in tuition fees of the independent colleges has been much greater than the increase in the fees charged by the tax-supported schools. And that price differential increasingly tends to shunt students into the schools which are supported chiefly by taxes. Independent colleges now charge, on the average, about $580 per year for a full course of instruction while the tax-supported institutions charge, on the average, about $240.

Bigger Tax Bill in Prospect

A large increase in the total enrollment in our colleges and universities during the next decade is in prospect, particularly when the great increase in births during World War II is reflected in the number of young men and women of college age. With a total of 2.5 million students at present enrolled in our institutions of higher learning, it is estimated that the total will be over 3 million by 1960.

If this trend continues most of the anticipated increase in college and university enrollment will be concentrated in tax-supported institutions. Indeed, if the shift toward tax-supported institutions that has occurred in the last three years were to continue over the next six years at the same rate, about two million of the three million students anticipated in 1960 would be in tax-supported colleges and universities and one million in independent schools. In 1950 there was a 50-50 division in enrollment. This shift would mean, of course, a corresponding increase in the tax bill for tax-supported education. And of this bill, we can be sure that an ample share would be assessed against business firms.

No Easy Solution

The best way, of course, to put a brake on a soaring tax bill for higher education is to help the independent institutions get in shape financially to carry a larger share of the student load. For most companies the development of a mutually satisfactory program of financial aid for higher education is a complicated process. In fact, it is so complicated that some companies with an initial disposition to provide financial help are inclined to despair of working out a mutually constructive plan.

If, however, the leaders of business will contemplate seriously the only available alternative to their extending voluntary help to our independent colleges and universities, their determination to work out a plan will be strengthened. For that alternative involves a grave weakening of our system of higher education, together with an involuntary increase in the financial support of higher education by business. The increase would come through higher taxes. Contemplation of such an alternative should, if necessary, toughen the will of business firms generally to do everything possible to extend financial help to our independent colleges and universities.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

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Donald C. McGraw

PRESIDENT

McGRAW-HILL PUBLISHING COMPANY, INC.

OPERATIONAL FAILURES BY MONTHS FOR APG-X FIRE CONTROL SYSTEM

	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.
CAPACITORS												
Avg.	0.40	0.83	0.60	0.50	0.53	0.61	0.60	0.73	0.60	0.33	0.67	0.77
Crit.	4	5	4	4	4	4	4	4	4	3	4	4
C-617	4	13	5	10		8	6	12	8		9	7
RESISTORS												
Avg.	0.36	0.34	0.36	0.26	0.44	0.58	0.44	0.28	0.54	0.32	0.46	0.22
Crit.	4	4	4	3	4	4	4	3	4	3	4	3
R-838	4	4	6	3	7	9	7	3	7	5	4	6
R-1106	4	6	6	6	11	13	6	4	12	7	7	7
TRANSFORMERS												
Avg.	6.3	4.5	3.9	2.9	3.9	6.3	2.6	6.9	6.1	5.0	5.3	6.3
Crit.	13	11	10	8	10	13	8	14	13	11	12	13
T-901	23	18	14	10	16	22	11	30	23	21	22	22
T-1201	18	15	13	8								
TUBES												
Avg.	12.4	10.6	11.2	9.4	7.6	8.2	10.0	6.4	10.6	13.6	12.4	10.0
Crit.	21	19	20	18	15	16	18	13	19	23	21	18
V-310			20		17		18	16			23	
V-1201	79	64	62	59	59	52	64	35	66	71	61	74
V-1202	44	54	47	43	34	27	34	25	40	61	54	39

(Average number of failures per month for the entire command)

(Based on average this is the critical number of failures)

(Failures are considerably above the critical level, making it likely that cause can be found and corrected)

(During June, defect that was causing excessive number of failures was apparently corrected)

(This tube is marginal. Cause may be difficult to determine)

Reliability Symposium Puts Finger on . . .

Key to Avionics Improvement: Feedback

Punch-card techniques to sort field data and get it back to industry could mean better performance.

Punch-card machine techniques developed by the Rand Corp. should enable military and industry managements to quickly spot trouble areas in equipment reliability and in organization operations.

With the Rand techniques, punch-card machines can sort through masses of field failure data, automatically extracting and summarizing information on those equipments, components, or organizations which have abnormally high or low numbers of failures.

The procedures were described by Dr. F. A. Hadden of Rand during the recent National Symposium on Quality Control and Reliability in Electronics held in New York. L. W. Sepmeyer co-authored the paper.

▶ **Feedback the Key**—The principle of feedback, basic cornerstone of automatic control system design, is also the key to improved avionics reliability. This point was made frequently by symposium speakers.

In fact, the use of the word "feedback" and the use of flow-type block diagrams occurred so often that the proceedings might have been mistaken for a meeting of servomechanisms engineers.

Speakers urged the feedback of information to:

- **Management**, both military and industrial, on significant equipment maintenance problems.
- **Component vendors** on performance and shortcomings of their products.
- **Equipment designers** on the details of field failures and on the availability of new techniques and components.

The two-day symposium, attended by nearly 400 engineers and scientists, was sponsored by the Institute of Radio Engineers and the American Society for Quality Control.

Management Feedback

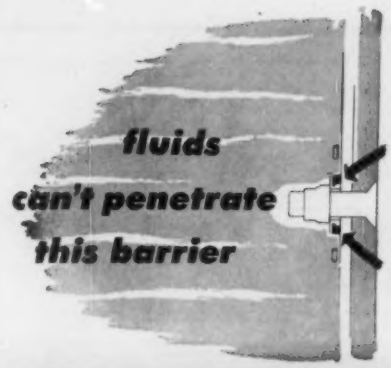
Military equipment always is pushing the "technological horizon," which prevents it from reaching a mature stage of reliability before going into service, Dr. Hadden pointed out. "The lessons of field experience must be quickly introduced into current equipment and the design of future equipment," Hadden added.

New field failure report systems, such as the Sperry, General Electric, Rand, and the more recent standardized Defense Department system, provide a promising source of mass data which can be quickly converted to punch cards for machine collation and tabulation (AVIATION WEEK June 7, 1954, p. 65; Sept. 20, 1954, p. 60).

However, a major portion of this mass of data represents random type of failures, of little significance to military and industrial managements. This "noise" in the feedback signal may obscure rather than pinpoint trouble areas.

▶ **Filter Needed**—Servo engineers might say that high- and low-pass filters are needed. Dr. Hadden expressed it this way:

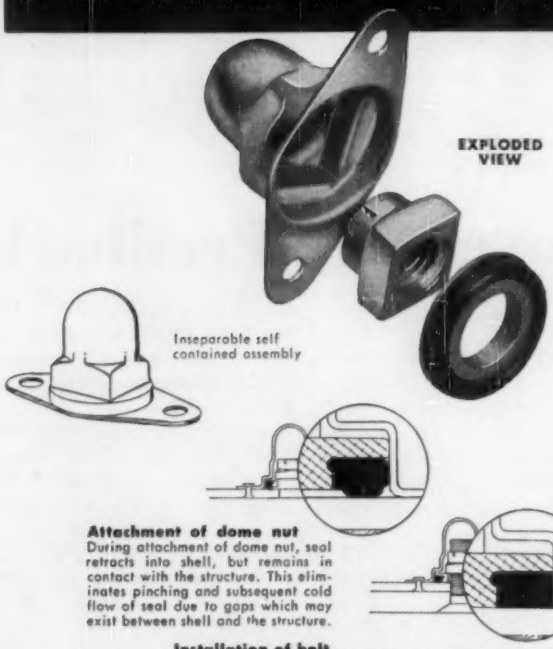
"What is needed is a means of determining and portraying in a clear, nontechnical manner, critical difficulties in equipment and organizations. Such a system must inform management what the critical difficulties are



IN THIS SELF-SEALING DOME NUT

11 PRIME MANUFACTURERS Specify THIS NUT

for integral fuel tank sealing on aircraft in production



Attachment of dome nut
During attachment of dome nut, seal retracts into shell, but remains in contact with the structure. This eliminates pinching and subsequent cold flow of seal due to gaps which may exist between shell and the structure.

Installation of bolt
Installation forces the bearing surface of sealed washer to contact the structure, providing positive single point sealing.

FEATURES

- ★ High pressure sealing without sealing compounds
- ★ Inseparably self-contained assembly
- ★ Single point seal
- ★ Floating nut with stationary seal, unaffected by successive bolt installations
- ★ Reduces Installation Time Weight and Maintenance

SPECIFICATIONS

Self locking nut conforms to applicable requirements of AN-N-5. Floats .025 in all directions.

BUNA-N type seal conforms to requirements of MIL-R-6855 for aircraft fuels Type 1, 2 and 3. It is also resistant to air, salt water, oil, gasoline and most organic solvents. Temperature range: −80°F to +225°F continuous operation. Pressure range ±50 psi constant or fluctuating operation.

SILICONE type seal. Resistant to hot air, ammonia, synthetic oil. Temp. range −80°F to +450°F continuous operation.

The range of materials and sizes now available has been greatly expanded. Pick the part number that meets your specific requirements from the following chart of production types.

Thread Sizes	Steel shell & nut; aluminum washer; Buna-N seal	Steel shell, nut & washer, Silicone seal	Steel shell aluminum nut & washer; Buna-N seal	Corrosion-resistant steel shell & nut; aluminum washer; Buna-N seal
6-32 NC-2	4630H-62	4630HA-62	—	4730H-62
8-32 NC-2	4630H-82	4630HA-82	—	4730H-82
10-32 NF-3	4630H-02	4630HA-02	—	4730H-02
¼-28 NF-3	4630H-048	4630HA-048	4530H-048	4730H-048
5/16-24 NF-3	4630H-054	4630HA-054	—	—
⅜-24 NF-3	4630H-064	4630HA-064	—	—

NOTE: Any combination of shell, nut, washer and seal materials shown above can be readily assembled for your specific requirements.

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Manufacturers of self locking anchor nuts and special fasteners.

and how serious their effect is on a given mission."

Hadden and Sepmeyer conclude: "Most important, the manner of presentation must be such that the supervisory personnel responsible can observe the month-by-month effectiveness of their organizations in removing the difficulties."

▶ **Critical Failure Levels**—Based on the well-supported assumption that equipment and component failures normally are independent and occur at a random rate, Rand has developed criteria which enable punch-card machines to draw an arbitrary line between failure rates which are "very high," "high," "low," and "very low."

Rand has based its criteria for high and low failure levels on a 1% probability level, very high and very low levels on a 0.1% failure probability, figures which its experience indicates are a reasonable compromise. However, Hadden points out that any desired probability level could be used without affecting punch-card machine procedures.

▶ **Failure Level Formulas**—The average number of failures (m) for any arbitrary period, such as a month, is computed for similar types of squadrons, equipments, or components. The significance levels can then be computed from the following equations:

- **Very high:** $m + 3.09\sqrt{m} + 1.6$
- **High:** $m + 2.33\sqrt{m} + 1.1$
- **Low:** $m - 2.33\sqrt{m} + 0.0$
- **Very low:** $m - 3.09\sqrt{m} + 1.2$

Suppose that the tube failure rates in fire control equipments used in several F-86D squadrons are under analysis. If the average number of tube failures per month per equipment for all squadrons is 9, then the corresponding failure significance levels are:

- **Very high:** 20 tubes/equipment/month.
- **High:** 17 tubes/equipment/month.
- **Low:** 2 tubes/equipment/month.
- **Very low:** 1 tube/equipment/month.

▶ **Spotlight on Trouble**—By means of Rand-developed procedures and formulas, punch-card machines can be set up to sort masses of failure reports into any or all of the above categories, then print up a summary of the results.

This might reveal that Squadron X is experiencing 21 tube failures/equipment/month, a situation which obviously needs investigation. Possibly the squadron's maintenance personnel or procedures are inadequate. Maybe the equipment is being misused.

If the sorting shows that Squadron Y is in the low-to-very-low category, with 1-2 tube failures/equipment/month, an investigation may show that it has developed new maintenance or operating procedures which should be passed along to other squadrons.

The procedures outlined in Hadden and Sepmeyer's report can provide month-by-month comparison of equipment reliability by squadrons, showing critical equipments, components, or operating groups (see examples, p. 54).

Hadden cautioned that the Rand formulas are valid only when the data is based on actual failures. If the data includes equipments or parts removed during preventive maintenance, the formulas cannot be used.

▶ **Cautions on Semantics**—While commending the intent behind the Defense Department's new standardized field failure report form, Hadden cautioned on difficulties that may result from its use. Failure report form terminology must be familiar and commonplace to GI maintenance men who fill out the cards; yet there is considerable divergence in terminology between branches of the service, and even within the Air Force.

For example, if the report is to ask when the equipment failure occurred, such terms as "inflight operation" or "preflight checkout" are excellent for airborne equipment, but they have no meaning for men working on ground-based air defense radar.

▶ **No Common Form**—"The compromises necessary to phrase some questions so that they mean the intended thing to people in different categories

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F-86D Airplane & Equipment Failure Rate per 100 A/C Hours

(In-flight failures only)

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Airplane, All Equipment						
Average for command	29.3	22.5	24.2	26.8	20.1	23.0
Squadron failure level						
94F			H	H		L
319F					H	VH
343F				VL		L
521F	H		H	H		L
618F		H				
746F	H				H	H
Fire Control Systems						
Average for command	15.9	17.1	16.0	12.0	19.0	15.0
Squadron failure level						
317F				L	L	L
319F		H	H		H	VH
521F	H	H	H	VH	H	H
618F	H	VH	VH	H	H	
Communications Equipment						
Average for command	4.3	2.8	1.5	2.5	3.0	2.0
Squadron failure level						
317F		L	L		L	
764F	VH	H		H	H	VH
Engine Control System						
Average for command	6.5	7.1	3.0	5.0	4.5	4.0
Squadron failure level						
317F		H	VH	H	H	VH
343F			H			L
618F				L		
Airframe and Powerplant						
Average for command	2.7	3.9	2.1	1.5	2.2	2.0
Squadron failure level						
94F	H	VH	H	H	H	
317F	H		VH	H	H	H
343F		L	VL	L	L	VL

Failure Level
VH = Very High
H = High
L = Low
VL = Very low

Simplified reliability report, prepared by punch-card machines, shows up only extremes in equipment/airplane reliability for management. Figures shown are hypothetical.

usually result in confusing them all," Dr. Hadden believes. "The important consideration both for intra-service and inter-service reporting is to be able to compare results," Hadden said.

"This requires similar data, but not a common form. The price of uniformity far exceeds its only gain—a single form to print and supply," Hadden said.

Vendor Feedback

Most avionic equipment failures result from component failures, due either to their misapplication or poor quality.

The former type of failure may be the fault of the equipment designer or component manufacturer; the latter is solely the responsibility of the component vendor. However, the component manufacturer usually is the low man on the totem pole when it comes to getting information on the performance of his product in the field.

Equipment manufacturers were urged to pass "part of the quality burden to part vendors," by C. M. Ryerson, engineering reliability administrator for Radio Corporation of America. Representatives of Hughes Aircraft, General Electric, and Bendix Radio reported that their companies have set up to do this, on at least a limited basis.

▶**Vendor Rating Systems**—Bendix Radio gives a numerical quality rating to each product they buy from more than 2,500 vendors. H. C. Newton, manager of the company's quality control department, calls this system "one of the most effective quality control tools."

Reject data collected by incoming inspection is recorded and processed on punch cards, then summarized monthly. When these summaries point up a quality problem, Bendix invites the vendor into its plant to discuss ways of solving it.

▶**GE Too**—General Electric employs a similar system, with monthly tabulations showing the percentage of defective material received from each vendor, according to George M. Armour of GE's Heavy Military Electronics department.

If reject percentages exceed certain limits, vendors are notified and called in to explain. If improvements are not forthcoming, the vendors are dropped from GE's approved list of suppliers.

GE also tabulates component failures during equipment assembly and testing. These punch cards are sorted weekly to establish quality trends and as a check on prior inspection.

▶**Proves Out at Hughes**—Hughes Aircraft also employs a vendor rating system with its 5,000 outside suppliers. This system was a major factor in HAC's cutting system rejects in final test from 17% in 1953 to only 8% in 1954, according to D. A. Hill, director of the company's quality control group.

HAC field engineers are now returning failed parts, together with a detailed history of the part failure, to better enable equipment designers to establish the true cause of failure.

In many cases, the failed part is returned to the original vendor for his analysis, a move which meets with hearty vendor approval, Hill said.

Designer Feedback

Symposium speakers agreed that the feedback of detailed and quantitative information on field performance and failures to equipment designers is an important step toward improving reliability. The new field failure reporting systems promise to speed the feedback of such data.

▶**Vital Feedback Loop**—Although Hughes reportedly is studying the GE and similar field reporting systems, Hill called HAC's field engineering group "the most vital feedback loop in our entire system." Trained Hughes specialists, stationed at every U. S. and foreign base where HAC equipment is used, transmit back detailed performance and reliability data.

These field reports are reproduced and widely distributed within the company. In addition, "IBM equipment is used to compile this information into a reservoir from which repetitive failures and significant quality trends can be immediately observed," Hill reported.

Hughes has another source of feedback, not available to many avionic equipment manufacturers—the fire control overhaul depot which the company operates under USAF contract. "Here we learn more of what actually happens to equipment after continued service in the field," Hill said.

▶**RCA Ideas on Feedback**—RCA's Ryerson cited several areas where information feedback to equipment designers could do much to improve reliability and which should be part of a company's reliability program.

Ryerson called for information feedback on:

• **Operational environment** conditions

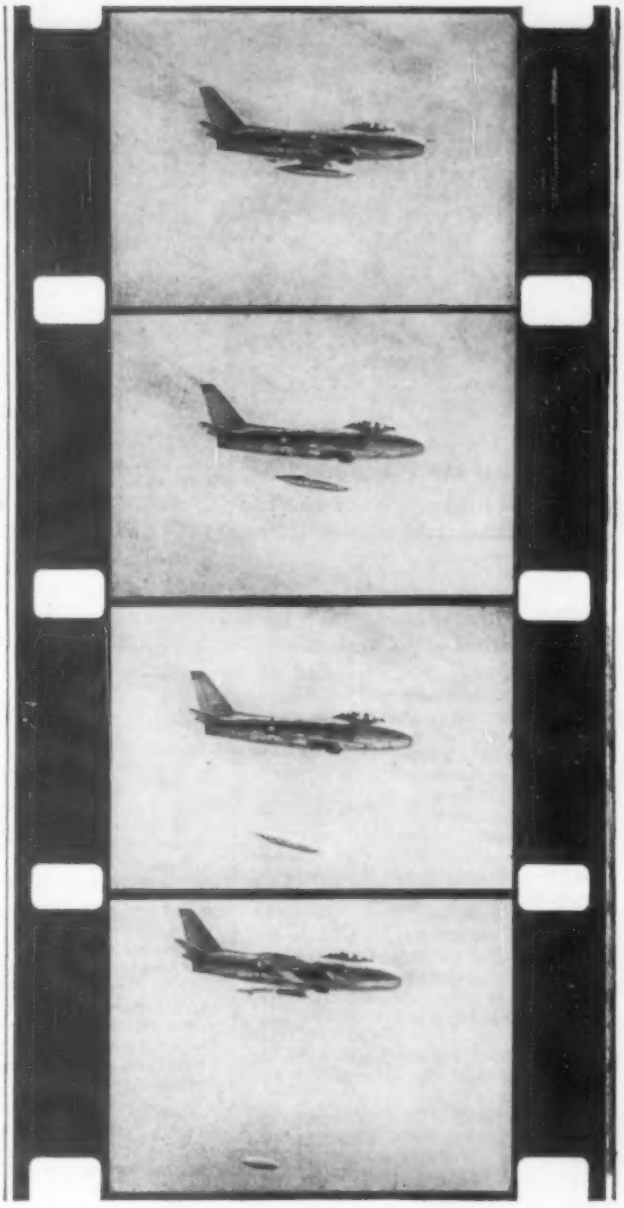
FLIGHT TEST FILMS OF NEW DUAL PISTON EJECTOR

Plane: North American F86F

Place: Edwards Air Base

Date: June 10, 1953

NOTE:
Hi-Speed camera reveals clean separation accomplished by uniform acceleration, high velocity with low peak force. Operational at transonic or supersonic speeds.



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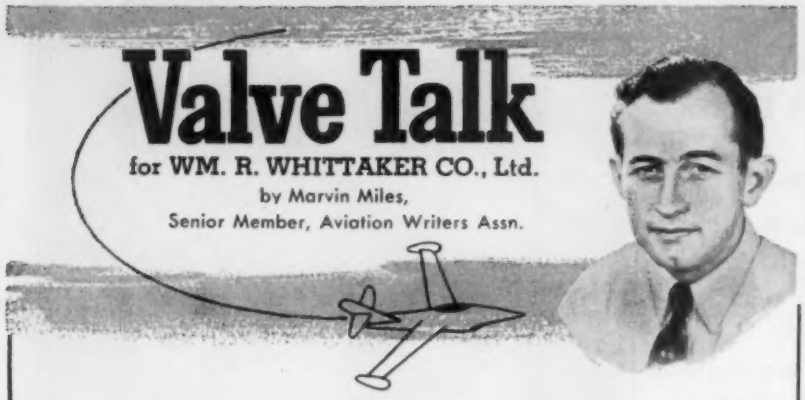
Engineers looking for a future, submit resumé.

Valve Talk

for WM. R. WHITTAKER CO., Ltd.

by Marvin Miles,
Senior Member, Aviation Writers Assn.



"The big problem," said Frank McCord, "is finding time to do all that must be done."

As Whittaker's chief engineer, Frank is top trouble shooter in the "headache" department—the valve company's test laboratory.

"We're concerned mostly with problems and we're constantly looking for trouble," he went on. "For this reason we're always hypercritical of all designs, an occupational ailment, I suppose."

The bustling test lab currently has 37 active projects underway and a backlog of 43 more awaiting parts or scheduling. About twenty percent of this total will be sub-contracted—routine studies of explosion proofing, salt spray effects, moist fungus, etc.

Responsibilities of the lab fall into four general classifications, prototype testing, qualification testing, research and operational checks. To these might be added a fifth category—re-test, the prosaic name for trouble that can strike any project.

"If all tests went smoothly, if every component performed perfectly, our job would be a cinch," Frank explained. "The work really starts when complications develop. It's a formidable task requiring the combined efforts of the design engineers, the test engineers and the shop people."

When problems loom, they involve not only exhaustive analysis and painstaking correction by the lab crews, but tricky re-scheduling of test programs on the basis of priority and possibly flight safety, revising reports and keeping customers informed at regular intervals on project progress.

"We can keep abreast—perhaps a little ahead—of surging advances in aircraft and missile performance only if we continually explore unknown phenomena, delve into new compounds, new materials, new designs, pry into super-critical temperature ranges, vast pressures and flows," Frank continued.

"Such applications naturally expose us to hidden troubles, some of which show up in initial test, some in prototype stage, some even later under the pounding of operational use. But in every case we do our level best to assure quality and dependability as prescribed by customer specs and Whittaker tradition."

The company's backlog of qualification testing, Frank said, has doubled within the last year to mirror the progress of the industry and gauge the numbers of experimental aircraft and missiles under development.

In Whittaker laboratory tests, he commented, three to four units of a given valve are put through the test chambers simultaneously after the basic design has been proved. This speeds up qualification and establishment of calibration data. To fully qualify a valve requires from ten to twelve weeks and costs between $3500 and $4000.

McCord, who started with Whittaker seven years ago when the lab comprised but three men working in a single test chamber little larger than a closet, explained that the valve company, for the most part, plans its test programs strictly to customer-approved specifications which in turn reflect military requirements.

Units frequently are pushed far beyond these limits in the quest for data, however, and in addition special tests are set up for the company's independent developments which are tortured to destruction in many cases.

Practically all of the test equipment used in the two laboratory buildings was designed and built by Whittaker, including facilities for testing synthetic oils at high temperatures, high flows at both low and high pressures, fluid and hot air controls, vibration, humidity, altitude, leakage, sand and dust effects, yield points—test rigs, in fact, for all types of environmental and structural conditions to rigid extremes.

Due to the driving nature of the industry today, the lab must constantly balance time allotted, customer requirements and the innate desire for product efficiency and reliability to meet all three demands—no easy task.

Then, after completing the job, come the final reports, factual and complete, turned out by technical writers in average ten-day sessions...

Overall, day in and day out, I'd describe test lab work as vital, exacting, demanding, challenging—and ulcer-producing.

(Advertisement)

which equipment will encounter in use.

- **Knowledge and experience** gained by other engineers within and outside the company.
- **New sources of supply** for components and materials and reliability data on new components and materials obtained from special tests.

Ryerson also urged equipment designers to:

- **Develop alternate circuits** and evaluate them to see which offers the greatest reliability for the present state of the circuit and component art.
- **Analyze possible misapplications** of equipment in operational use.
- **Design safety factor** into equipment so that performance will not seriously deteriorate in manufacture, storage or use.

▶ **Northrop Program**—A comprehensive tube surveillance program aimed at locating and correcting tube-circuit incompatabilities, an important cause of equipment unreliability, was reported by Karl F. McCready of Northrop Aircraft. (David E. Conklin co-authored the paper.)

A secondary objective of the program is to determine the quality of tubes that are obtainable at the present time and to evaluate various tube testing procedures.

Northrop carefully numbers and then tests all tubes to MIL-E-1B spec requirements, recording its findings on punch cards for future references. If a tube passes these tests but later malfunctions or fails to perform properly when subjected to system tests, a special group in the Northrop reliability section analyzes the problem.

Where the analysis indicates that tube improvements are needed, Northrop transmits such recommendations to the armed services in the form of recommended additional specification controls on the particular tube characteristics.

Where circuit improvements are indicated, specific data showing the magnitude of the problem and the degree of improvement required is fed back to Northrop's own circuit design engineers.

▶ **Pot Luck**—In some instances a more extensive investigation is needed in which case a "special problem analysis" is launched.

For example, Northrop system tests were rejecting a number of amplifiers whose balancing potentiometers apparently lacked sufficient range. The value of pot resistance had to be as small as possible to give good resolution, yet large enough to accommodate any tube whose characteristics met the MIL tests.

A pot with 2,000-ohms resistance had been selected on the basis of original calculations. However, special problem analysis showed that the fault lay

neither with the pot nor the tubes in themselves, but arose because of an

the Unicom frequency (122.8 mc.) by pressing a button. LTR-6GH operates

Phil-trol®

Data for Relay Users

New Phil-trol Relays Available with Printed Circuit and Taper Tab Terminals

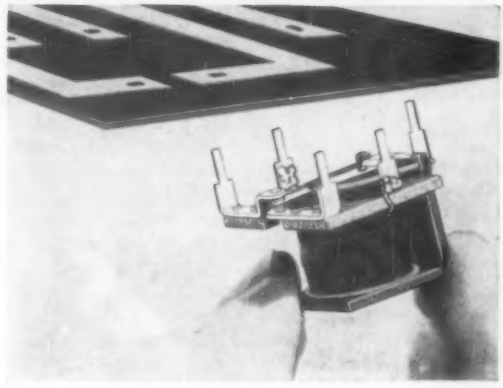
Phil-trol Engineering, in its constant policy to keep abreast and ahead of the rapid progress in electronic design and production techniques, has developed several new relays. Those shown here illustrate a completely new sub-miniature type, the minute, featherweight Phil-trol "15" series. They are available with printed circuit terminals as well as with standard soldering lugs.

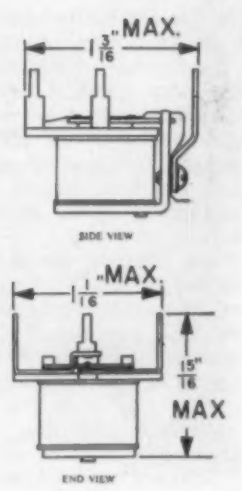
Also shown is the popular, improved Phil-trol type "8" relay, available with printed circuit or Taper Tab terminals.

In designing these new relays Phillips Control Corporation applied their long specialized experience and their same standard practice of producing the finest relays possible for the intended applications. And to achieve greatest economy commensurate with top performance and long, dependable life.

The new Phil-trol "15" series, and the improved type "8," added to the Phil-trol line, further broaden the unusually wide selection of Phil-trol Products available for practically every relay application.

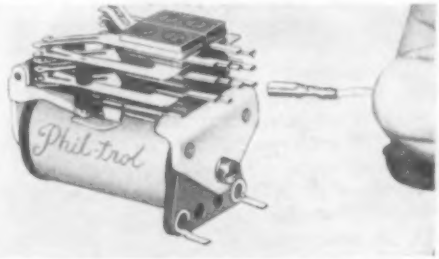
You are invited to call upon the comprehensive Phil-trol Engineering Service to help you determine the exact Phil-trol relay best for your application—or to work with you on "special" problems—without obligation.

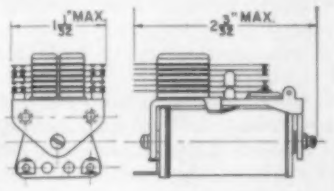




Phil-trol Type 15QA with printed circuit terminals of brass. Contacts are silver. Shown actual size—weight is approximately 1 ounce. Also available with standard soldering terminals.

Here is the new **Phil-trol Type 15QA Relay** (above). Sub-miniature in size, light in weight, it is ideal where dependable performance is a "must"—as in delicate instrumentation, Radiosonde equipment, or the Autronic Eye. For DC operation up to 60 V., with contact 1 Form C (S.P.D.T.).





This **Phil-trol 8QA, DC relay** is equipped with the new wedge action Taper Tab terminals for simple, fast, positive connections. No soldering problems. Phil-trol Engineers have made the 8QA available in a Taper Tab model to save time and labor in assembly. It is also available with printed circuit terminals.

The **Phil-trol 8QA** is highly sensitive, provides fast opening and closing. Heavy duty, long-life bearings give precision operation. Contact springs are equipped with twin contacts to assure maximum reliability. Operating voltage up to 230 volts DC. Weight is approximately 3 ounces.

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neither with the pot nor the tubes in themselves, but arose because of an overall adverse buildup of tolerances.

Tests on a limited number of tubes plus statistical extrapolation enabled the Northrop reliability group to recommend a 7,300-ohm pot, which eliminated the difficulty, McCready said.

▶**Feedback to Supply**—Adequate provisioning of spare parts for electronic equipment is called "one of the most serious problems of military supply" by Hadden and Sepmeyer in their paper.

In the past, spares have been stocked on the basis of an arbitrary percentage of the number of equipments in use, with extra numbers of failure-prone components provided on the basis of engineering or experience estimates, the Rand scientists pointed out. The result often has been serious shortages of many critical items, an oversupply of others.

Now, however, the recently devised field failure reporting systems can be used to provide actual parts consumption data, providing that all part replacements (including preventive maintenance) are included in the reporting system.

However, preventive maintenance replacements must be carefully identified so as not to introduce spurious data into field failure analyses, Hadden and Sepmeyer said.

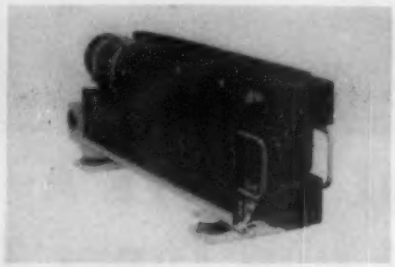
Avionics Firms Tell Of New Expansions

Kay Lab, fast-growing San Diego avionics firm headed by LaMotte T. Cohu (former president of Convair), has announced plans to build a new 30,000-sq. ft. facility. This is one of several recently announced avionics industry expansions. Others include:

• **Ultrasonic Corp.**, Cambridge, Mass., has purchased the Stamford Electronics Co., maker of test equipment. The move is expected to increase Ultrasonic's activities in the fire control and missile fields. Stamford Electronics' key personnel and facilities will be moved to Cambridge.

• **Polarad Electronics Corp.**, Brooklyn, N. Y., has acquired 55,000 sq. ft. of new plant in Long Island City, N. Y., as part of company's program to expand its activities in the fields of computers, klystron tubes, and microwave components. Company's executive and engineering offices will be located in the new plant.

• **Helco Products Corp.**, Santa Monica, Calif., makers of pressure control devices and precision pots, is expanding its plant facilities to specialize in the manufacture of tiny precision potentiometer elements which form integral parts of customer's product.



LTR-800 VHF transmitter-receiver.

New VHF Unit Offers 800-Channel Range

A new 800-channel VHF transmitter-receiver, with 50-kc. channel spacing over the 108-to-148-mc. band, has been announced by LearCal Division of Lear, Inc. The new LTR-800, with transmitter rated at 8-w. output, comes in a ½ ATR size package and weighs less than 25 lb., including inventer. Unit is designed for 14- or 28-v. d.c. operation.

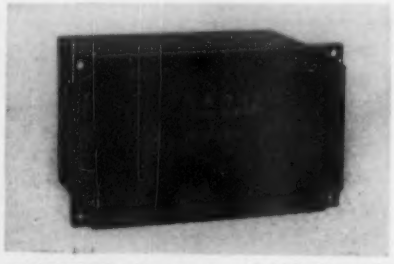
The new LTR-800 permits transmission and reception on the same frequency with a single setting of the remote tuning selector, although operation on separate frequencies is possible if desired. Another feature: When transmitter is not being used, its modulator can be used to boost receiver output sufficiently to operate cockpit and cabin speakers.

The VHF receiver is crystal-controlled, with sensitivity better than 1 microvolt for 500 mw. of audio power output with single-to-noise ratio of 10 db. or better, Lear says. Company adds that spurious receiver responses, including image responses, are down not less than 60 db.

First production models of the LTR-800 are expected this summer. Specifications are available by writing to company at 3171 So. Bundy Drive, Santa Monica, Calif.

▶**New Unicom**—Lear has also announced a new two-way VHF ground-to-air communications set, Model LTR-6GH, containing a 10-w. crystal-controlled transmitter, tunable receiver, built-in power supply, speaker, mike.

VHF receiver, covering range of 108 to 127 mc., is tuned with slide-rule dial, and can be calibrated precisely at the Unicom frequency (122.8 mc.) by pressing a button. LTR-6GH operates from 110 v. a.c., but is also available for 6-v. battery operation.



SELECTOR chooses any of 800 channels.

Engineers Get New Test Equipment

A variety of new electronic laboratory test equipment of interest to engineers in the avionics field was announced recently. Among the devices:

• **Variable-frequency generator,** Model 1420-B, covers range of 50 to 6,000 cps. with internal oscillator, up to 20 kc. with external oscillator. Power output is 300 va., distortion under 2%, and regulation less than 2% from no-load to full-load, according to manufacturer. Several output voltages between 80 and 270 are provided. Manufacturer: Communication Measurements Lab, Inc., 350 Leland Ave., Plainfield, N. J.

• **Electronic switch,** Type 330, converts any cathode-ray oscilloscope into a dual trace unit over the range of d.c. to 15 mc. Switching may be triggered from the oscillograph-gate output at rates of 0 to 100 kc., or may be set at recurrent rates of 1, 10, or 100 kc. Manufacturer: Instrument Div., Allen B. DuMont Labs, Clifton, N. J.

• **VSWR amplifier,** Type 277, a low-noise, high-gain, low-cost audio amplifier for use with slotted sections in measuring VSWR over the range of 1 to 100. Device has 0.3-microvolt sensitivity over full scale, manufacturer says. Special circuitry provides expanded meter scale for accurate reading of VSWR between 1.0 and 1.3. Selector switch permits operation with either 15 or 50 cps. bandwidth centered at 1 kc., or broadband operation from 350 to 2,500 cps. Manufacturer: Polytechnic Research & Development Co., Inc., 202 Tillary St., Brooklyn 1, N. Y.

• **Fixed-frequency oscillators** provide 2 watts of sine-wave power at 10 v., with less than 0.08% harmonic content at any frequency, factory set to customer's requirements, in the range of 300 to 10,000 cps. Frequency shift between no-load and full-load is reportedly less than 0.16%. Manufacturer: Neucor, Inc., 45 West Union St., Pasadena 1, Calif.

Small Radio Used In Ocean Crossing

A new small lightweight HF transmitter-receiver for light and business plane use where longrange communications are desired is available with five or 11 crystal-controlled channels for operation in the 2 to 10-mc. band.

The new SunAir set was used by Max Conrad on his nonstop New York-

Guidance—absolute and instantaneous! Imperative to the missile that seeks out and destroys an enemy! Imperative to the automatic homing that brings an airliner to its destination. Into these guidance computers go RESOLVERS which translate positioning data into electrical impulses. Because of their vital role, the Armed Forces demand RESOLVERS of the highest precision . . . and Ketay supplies them.

VITAL TO GUIDED MISSILES

INSTRUMENT

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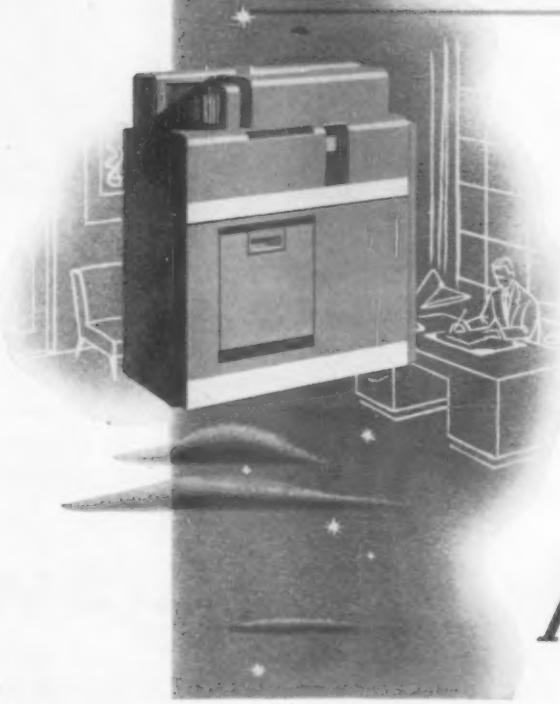

Industry, too, is using RESOLVERS. For example, RESOLVERS are used in analog computers which are saving thousands of man-hours in solving mathematical problems relating to research, quality control, and production techniques.

Ketay is a major supplier of RESOLVERS to both the military and leading industrial firms. They are specialists in the design, development and manufacture of

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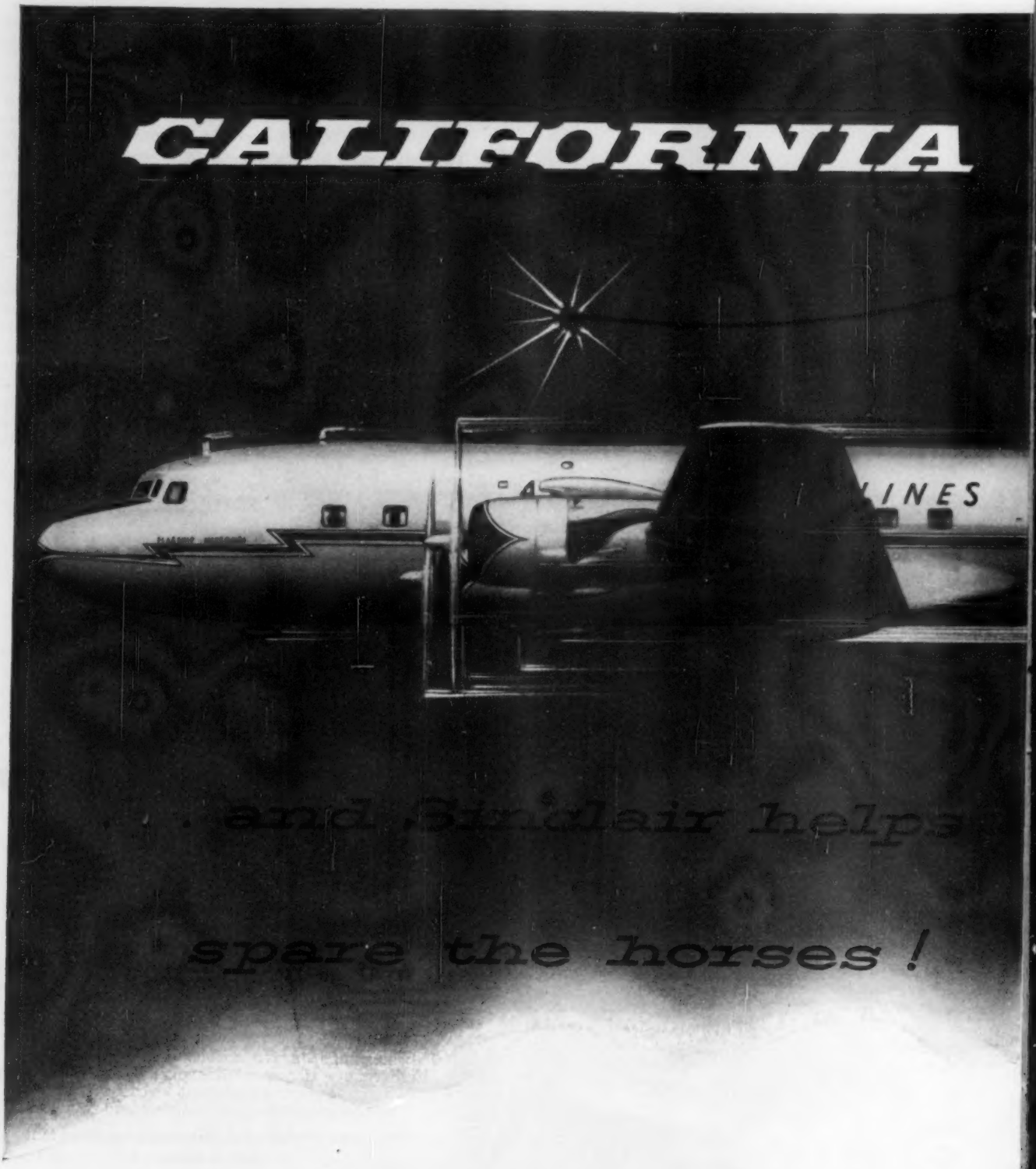

Tuner is standard console type covering three bands: 190-430 kc, 480-1,025

12-page bulletin describing advantages of copper-clad Phenolite printed circuitry.

It takes 13,000 horses to speed American Airlines' DC-7s on their nonstop hops across the continent. That's a lot of power to pull one plane—but, then, 365 miles-per-hour is a lot of speed for a commercial airliner. This speed plus the luxury of the DC-7 accounts for the fact that American has had to *triple* its new service in less than six months time.

High output engines such as those on the DC-7 demand the finest in lubrication. To protect its Turbo Compounds, American has again chosen Sinclair Aircraft Oil – as it has for the past 20 years. *Today, more than 45% of the oil used by major scheduled airlines in the U. S. is supplied by Sinclair.* Why not place *your* confidence in Sinclair Aircraft Oil?

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Sinclair Refining Company, Aviation Sales, 600 Fifth Avenue, New York 20 N. Y.

SUNAIR S-5-DTR weighs 23 lb.

to-Paris flight in a Piper Apache last November (AVIATION WEEK Nov. 22, 1954, p. 98). It comes in three different models:

• **S-5-DTR,** five channels, for panel mounting; measures 6¼ x 5 x 12¾ in.; weighs 23 lbs.; is priced at $795 including dynamotor, F.O.B. factory.

• **S-5-RTR** is functionally similar, but of the remote-mounted S-5-RTR; weighs 25 lb.; sells for $1,395.

• **S-11-RTR** is an 11-channel version of the remote-mounted S-5-RTR, weighs 25 lb.; sells for $1,395.

All models are designed for 12 or 24-v. d.c. operation. Manufacturer is SunAir Radio, Broward International Airport, Fort Lauderdale, Fla.

Other new radio communication and navigation equipments for aircraft include:

• **Avigator,** Model AT 99-45(A), combination omnirange and VHF communications receiver and transmitter, with low frequency receiver and direction finder, including a new supersensitive "whistle direction finder"; weighs only 11 lb.; measures 6¼x5x11 in.

Set permits simultaneous VHF communications reception while using low-frequency direction finder that can be used in conventional fashion or with new "whistle" feature, which improves homing sensitivity. Highlights include six-channel VHF transmitter, VHF receiver tunable over the 108-130 mc. band, and direct omni-bearing indication.

Manufacturer: Mitchell Industries, Inc., P.O. Box 17, Mineral Wells, Tex.

• **Automatic antenna tuner,** Model AAT Type 4, which manufacturer says meets essential requirements of Arinc Characteristic 525, automatically tunes all fixed wire antennas, grounded or open, on commercial aircraft ranging from Douglas DC-3s to Boeing 377 Stratocruisers.

Using only one tube, new tuner covers frequency range of 2 to 22 mc., weighs 16½ lb., and can be used with any HF transmitter having a 52-ohm coaxial output, nominal carrier power of 50-100 watts. No external RF relays are required.

Manufacturer: Aerocom, Miami 32, Fla.

• **Automatic direction finder,** Model ADF-15A, designed to meet both military and CAA specs, weighs 23 lb., including indicator and loop assembly. Tuner is standard console type covering three bands: 190-430 kc., 480-1,025 kc. ,and 1,025 kc. to 1,725 kc.

Ferro-dynamic loop is sealed against dust and moisture, has rotational speed of 30 deg./sec., or 90 deg./sec. if desired. Loop can also be driven manually to locate aural null.

Manufacturer: LearCal Division, Lear, Inc., 3171 So. Bundy Drive, Santa Monica, Calif.

Avionic Literature

Among new bulletins and catalogs recently issued, the following are of interest to persons in the avionics field:

• **Airborne Instruments** is title of new 56-page catalog of transducers, including accelerometers, pressure instruments and Machmeters, gyros (both rate and free), and vanes and probes. Application engineering data is included. G. M. Giannini & Co. Inc., 918 East Green St., Pasadena 1, Calif.

• **Telemetering components,** such as variable reactance oscillator, strain-gage oscillator, voltage controlled oscillator, crystal controlled phase-modulated transmitter, commutator-gaging unit, and dynamotor unit are described in technical bulletins TSS-A-874, A-949, A-957, A-960, A-CG, and A-DYN. Raymond Rosen Engineering Products, Inc., 32nd and Walnut Sts., Philadelphia 4, Pa.

• **Miniature relay,** hermetically sealed, specs and application data. GEA-6213. (4 pp.) General Electric Co., Schenectady 5, N. Y.

• **Mechanize Your Wiring** is title of new 12-page bulletin describing advantages of copper-clad Phenolite printed circuitry. National Vulcanized Fibre Co., Wilmington 99, Del.

• **Dictionary of Electronic Terms,** listing over 3,500 terms, edited by Dr. G. R. Partridge of Purdue University, is available for 25 cents from Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill. The 72-page booklet is identified by stock number 37 K 756.

• **Digital instruments,** series of five types for automatic counting, recording and control, are described in brochure available from Brush Electronics Co., 3405 Perkins Ave., Cleveland 14, Ohio.

• **Designers handbook** on cathode ray tubes for military and industrial use (40 pp.). Ask for ETD-985 General Electric tube, Schenectady 5, N. Y.

• **Telemetering aid,** an article entitled "A New System for Monitoring the Overall Transduction Ratio for Analog Recording Channels Employing Bridge Type Transducers," is available as Instrument Notes No. 28 from Statham Laboratories, Inc., 12401 W. Olympic Blvd., Los Angeles 64, Calif.

• **Voltage stabilizers,** available in power range of 5 to 2,000 watts, are described in 16-page catalog 4-260. Raytheon Manuf. Co., 6120-PR, Waltham 54, Mass.

• **Electronic test equipment,** including vacuum tube voltmeters, square wave generators, oscillators, bridges, power supplies, and wide band amplifiers are described in 4-page bulletin available from Shasta Beckman Instruments, Inc., 1432 Nevin Ave., Richmond, Calif.

• **Lear VGI,** remote vertical gyro and panel indicator system are described, application and design details given in a 16-page brochure. Lear, Inc., 3171 S. Bundy Drive, Santa Monica, Calif.

New French Radar Serves Orly Field

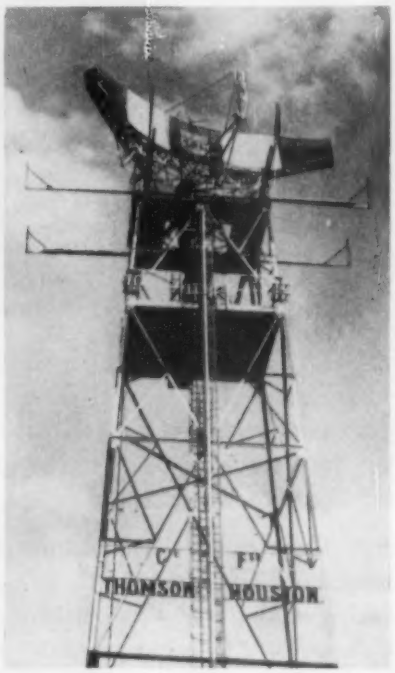
(McGraw-Hill World News)

Paris—Powerful new French surveillance radar recently installed at Orly Field near Paris, with its antenna mounted atop 50-foot tower, scans the skies at distances up to 95 miles and altitudes to 40,000 feet.

The 600-kw. radar, used by the Paris Regional Control Center, was built by Compagnie Francaise Thomson-Houston. The 23-ft.-wide parabolic antenna provides a narrow radar beam, 0.8 deg. wide, and rotates at 6 rpm.

In the control center (above), the monitored area is divided into six sectors with two operators working side by side on both radar and non-radar reporting, an arrangement that is unique in Europe.

Although the new radar presently is



used only to confirm pilot-reported positions, officials expect to extend its use gradually to direct traffic control permitting the reduction of present aircraft separations.

Paris Airport, consisting of Orly and Le Bourget, is the second busiest commercial air terminal now operating in Europe.

setting new standards for transparent enclosures

PLEXIGLAS 55

First used in 1952 for windows of the Douglas DC-6, PLEXIGLAS 55 was next specified for cockpit canopies of the Boeing B-47, shown above. Today this improved grade of aviation's standard transparent plastic is being used on more and more types of military and commercial planes.

Current production aircraft using PLEXIGLAS 55 include:

Boeing B-47	**Douglas DC-7, DC-6B, DC-6**
Cessna T-37	**Lockheed F-104**
Convair F-102	**Martin B-57B**
Douglas A4D	**North American F-100**

PLEXIGLAS 55 is characterized by notably improved craze-resistance and a higher maximum useful service temperature. Combined with the traditional clarity, formability and weathering properties of PLEXIGLAS acrylic plastic, these advantages provide significantly longer service life for transparent enclosures on current production aircraft. For the planes of the future, we are working to raise the quality of transparent plastic to an even higher level.

PLEXIGLAS is a trademark, Reg. U.S. Pat. Off., and in other principal countries of the Western Hemisphere.

CANADIAN DISTRIBUTOR: *Crystal Glass & Plastics, Ltd., 130 Queen's Quay at Jarvis Street, Toronto, Ontario, Canada.*

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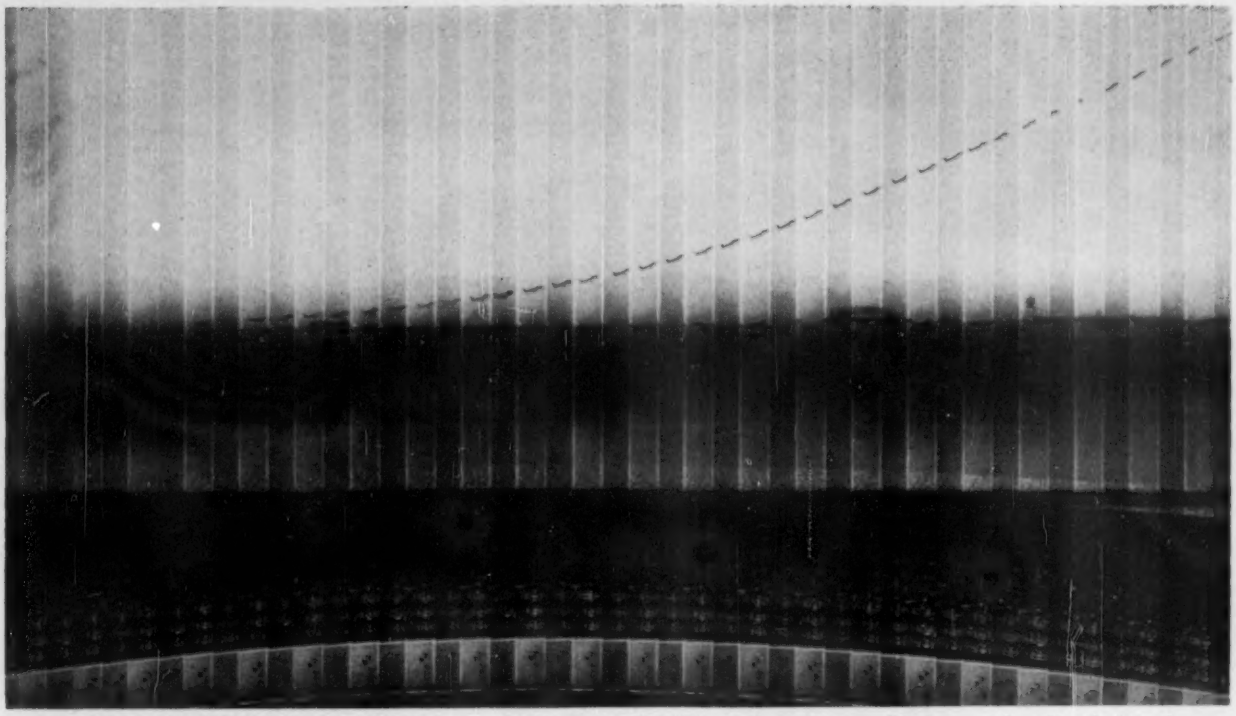


F-86E MAXIMUM PERFORMANCE TAKEOFF is recorded by Fairchild Flight Analyzer Camera. Photo was taken directly into the sun.

Flight Analyzer Camera Finds New Uses

A trio of new developments highlight the advances being made by Sherman Fairchild & Associates in the relatively unexplored field of data recording cameras and associated equipment. The instruments, which had been used to record and analyze takeoff, are now being used to study in-flight and landing characteristics of aircraft and missiles and many other aeronautical applications (AVIATION WEEK June 8, 1953, p. 55).

▶ **Acceptance & Diversification**—Karl Fairbanks, vice president of the firm, told AVIATION WEEK that these three programs are going forward at his company:

- **Model IV-A Flight Analyzer Camera** with 6-in. focal length lens is gaining acceptance at military test centers and with airframe manufacturers; 22 units have been contracted for to date.
- **Model VI-A Flight Analyzer Camera** with a 12-in. focal length lens has been manufactured and the first unit shipped to Eglin AFB, Fla.
- **Broader line** of photo data recording instruments is undergoing development.

▶ **Model IV-A**—Here is how the Model IV-A Camera photographs a moving target, such as a plane taking off: The camera (body, lens and photographic plate) remain stationary, while tracking a moving object with two, widespread handles moves a shutter across the plate so that it takes a series of strip pictures, each contiguous to the next, across the entire face of the plate, while superimposing a time record on each picture.

Since the plate remains in a fixed position relative to the plane's flight path (the two being lined up to be parallel), space position of the aircraft recorded on the plate is five to six times more accurate than anything obtained with previously used instruments, and data reduction time is sliced up to 50%, according to Fairbanks.

Among purchasers of the Model IV-A, Fairbanks lists Edwards, Eglin, Patrick and Rome AFBs, Patuxent Naval Test Center, and the Royal Canadian Navy. Reorders for some of these installations are now being negotiated.

Among the airplane companies purchasing the instrument are McDonnell, Bell, and Fairchild. Boeing-Wichita is using one to check B-47 takeoffs, and Goodyear is reported to have used the Navy analyzers to record sinking speed tests of lighter-than-air craft.

Cessna, Beech and North American have also expressed interest in the instrument, according to Fairbanks.

▶ **Model VI-A**—New version of the Flight Analyzer Camera, the Model VI-A, differs from the Model IV-A primarily in size and in the type of lens. The latter is equipped with a Bausch & Lomb 6-in. focal length lens. The Model VI-A camera uses a Kodak Aerostigmat, 12-in. focal length lens.

The 12-in. lens enables the camera to give the same size image from twice the distance, while covering a slightly greater field. Or, it can render greater detail than the 6-in. unit at shorter distances.

▶ **Broadening Applications**—Fairbanks points out that applications of the Flight Analyzer Camera are broadening as users become more familiar with its potentials.

For example, the camera was initially used primarily to record the takeoff and landing paths of aircraft. Now it is used for such applications as tracking missile launchings and trajectories, entry angles of torpedoes into water, and "the calibration of other precision recording instruments of extended range," Fairbanks says.

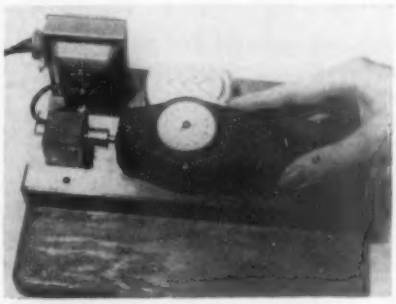
He believes this is only the beginning. For instance, the analyzer lends itself to the installation of a series of cameras along a predetermined flight

path with each camera radio-triggering auxiliary cameras, forming a complete photo-recording system.

▶ **Enlarging the Line**—Encouraged with the success of the Flight Analyzer Camera, Sherman Fairchild & Associates are actively engaged in developing a broader line of photographic data recording instruments. Among the new items are a miniature, highspeed, short-interval camera, a 24-in. ballistics camera and other instruments to record electronically presented events such as might appear on a cathode ray tube.

In addition, each photographic data recording instrument requires companion assessing devices which the company is preparing to provide. As an example, development is now under way of a read-out device to measure Flight Analyzer records and present data either visually or electrically for use with punched cards and computer devices.

As a result of these expanded activities, Fairchild plans to build a plant in Westchester County (suburban New York), where it will have room to increase both research and manufacturing activities.



INSPECTION rig uses force indicator.

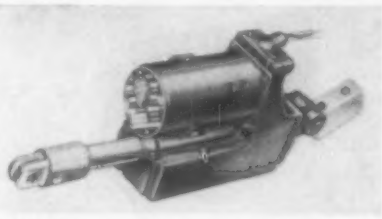
Force Indicator Rig Speeds Inspection

For speedier quality tests of precision-spring-actuated assemblies, a standard force indicator has been built into a special fixture having a buzzer and vulcanized fiber block containing the test piece.

The assembly is put into the block and the force indicator, having a special test fitting, is pushed forward so that it compresses the tip of the plunger. The test fitting meets the metal sleeve in the block at the test length specified by the user. A buzzer sounds, as the fitting and sleeve complete a circuit. The indicator then is backed off until the buzzer stops and the reading taken at the breaking point.

The specified load at the test length has been calculated, so indicator's dial should give the acceptable reading if the part is to be passed. In practice, the dial is marked with a grease pencil at the allowable load limits.

The rig was devised at the plant of Bard-Parker Co., Inc., Danbury, Conn., using a Hunter Spring Co. standard force indicator. Hunter's address: Lansdale, Pa.



LEAR 413 maintains positioning accuracy.

Miniature Actuator Fits In Thin Control Surfaces

An entirely new limit-switch system, eliminating backlash normally encountered in control gear trains and making possible more accurate stroke length positioning, is offered by Lear, Inc., in its new linear actuator for aircraft.

The actuator has applications in thin control surfaces, also in fuel dump valves and mechanical-advantage shifters.

Another benefit of the Lear Series 413: Ease of making position switch settings over a wide range of stroke positions. Once set, the firm notes, positioning accuracy is retained within close tolerances over a longer period of time than is common with conventional limiting devices.

The new Lear 413 series is designed for applications where weight and size are critical factors. Weight varies from 1.7 lb. Ultimate structural strength is up to 2,000 lb., maximum static strength to 1,300 lb. and operating output up to 500 lb.

Envelope size of the largest actuator in 413 series is $1\frac{7}{8}$x$3\frac{3}{4}$ in., with an overall retracted length of $7\frac{1}{4}$ in. Maximum stroke is 3 in. A radio noise filter is an integral part of the unit, designed to operate from a standard aircraft 26-v. d.c. supply.

Electrical leads can be brought out the front, bottom and either side of the housing, permitting flexibility in installation.

Lear, Inc., Grand Rapids, Mich.

Tester Makes Various Gyro Gunsight Checks

A testing-measuring device for checking gyro computing gunsights and indicating the equipment's operating characteristics has been developed by Telectro Industries Corp.

Model 519 sight tester has circuits for opening computer stiffness and sight head torque motor circuits; controlling the displacement of the target index; making characteristic time measurements; checking stiffness motor cur-

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rent, the torque motor voltages and checking excitation frequency and currents. Also indicated are proper cycling of thermal switches in the sight system.

Equipment, complete with five accessory cables, weighs about 60 lb. Case measures 14¾ x 19 x 15¾ in.

Telectro Industries Corp., 35-18 13th St., Long Island City 1, N. Y.

High-Purity Furnace Handles 50-lb. Batch

Moderate-scale production of high-purity metals or experimental or pilot-scale output is the purpose of the new Model 436 Stokes vacuum furnace having a melting capacity of 50 lb.

The furnace can be equipped with a tilting crucible and a 2-ft. turntable on which multiple molds can be supported for semi-continuous casting. It can also be fitted for vacuum sintering and casting by bottom pouring.

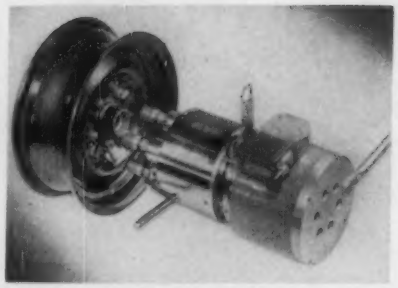
A 3-in. full-opening vacuum lock contains a bucket which holds the alloying materials to be added during melting. It also permits samples to be taken and temperatures measured by thermocouple without breaking the vacuum in the chamber.

Stokes Machine Co., Inc., 5500 Tabor Rd., Philadelphia 20.

Torque Wrench Lets Go At Finish of Job

A new powered torque wrench that automatically and completely releases when the fastener reaches predetermined torque is now available following a year of on-the-job testing by several companies. Trade name is Pow-OR-Tork.

Continuous and fully automatic operation is stated to eliminate inaccuracies sometimes encountered as a result of overcoming alternate static and dynamic



MULTISPINDLE model of torque wrench.

friction in the tightening cycle. The automatic release cycle obviates possibility of errors from misreading gages or other human error, as well as distortion or breakage caused by over or under reaching of desired tension, the maker points out.

Tool is available in mechanically supported single and multiple spindle wrenches to any bolt pattern and in numerous sizes. Operation can be designed for air power and torque may be remotely controlled.

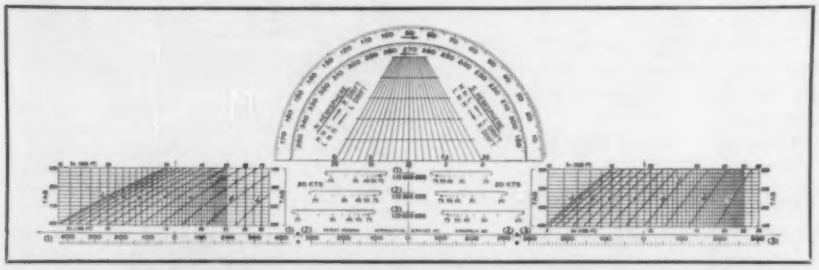
Ohlsson & Rice, Inc., 3340 Emery St., Los Angeles 23, Calif., is the manufacturer, under exclusive license from Torque Corp. of America.

Snow Compactor Builds Military Runways Fast

Toronto—Canada has developed a snow compactor capable of building a 3,000-ft. runway for a medium bomber in 45 hr. Work on the project has gone on since 1945. The United States reportedly assisted in the development.

The compactor chews up snow into the consistency of grain sugar and can also handle trees up to 6 in. in diameter. The principle is that snow will bear a great deal more weight when it is compressed than loose.

Experiments were carried out at Canadian air bases at Goose Bay, Kapuskasing and Fort Nelson, and at Thule, Greenland. It is reported that the machine cannot be used for strips for intercontinental bombers, since the planes are too heavy.



Pressure Pattern Scale Speeds Flight Planning

This pressure pattern plotter is designed to simplify computations and chart work needed in flight planning and pressure pattern navigation. Straight edge of the device is designed for distance measurements on weather charts of three different scales; beam-wind component scales are calculated for solution by inspection the component value for D-value change of either 100 ft. or 200 ft. for any given latitude from 15 deg.-75 deg. and for airspeeds of 150 kt. to 450 kt. Scales are said to be accurate at 50 deg. latitude on a chart with standard parallels of 30 deg. and 60 deg. Plotter and instructions are available from Aeronautical Service, Inc., Annapolis, Md.

ALSO ON THE MARKET

Processing chemical kit for oscillographic photo recording paper eliminates final water bath, increasing production by 50%, says the maker. Process enables use of new continuous processors that have no plumbing and are considerably more economical than other types. Total water needed with new process is six gallons.—Du Pont de Nemours & Co., Photo Products Dept., Wilmington, Del.

Cabinet or shelving capacity can be increased 30-70% using a new mobile storage system, whereby units are mounted on tracks, with rows close together. Sliding cabinets aside permits access to rear units. Space is saved by elimination of aisles.—Dolin Metal Products, Inc., 315 Lexington Ave., Brooklyn 16, N. Y.

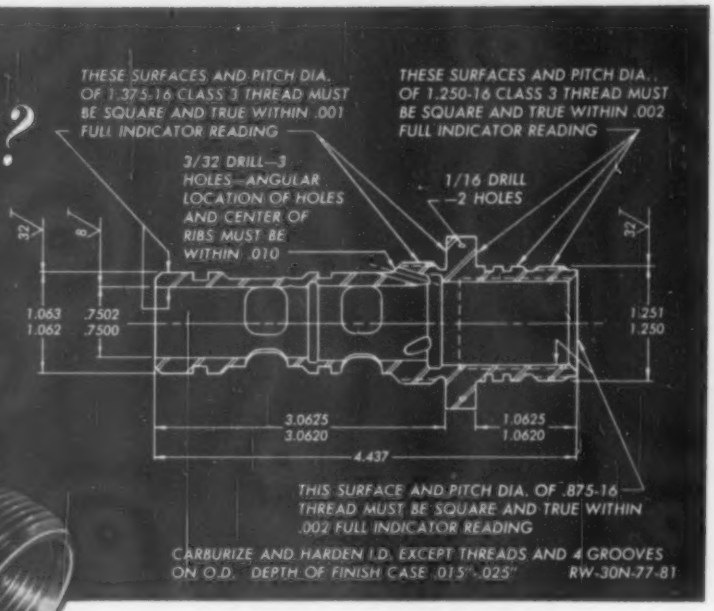
Rock-lock grommet that provides vibration-damping and part-positioning seal against liquid, air and dust (described in AVIATION WEEK Dec. 27, p. 68) is now being produced by Stalwart Rubber Co., the only authorized licensee, according to the inventor, W. H. Moorhead. Grommet will also serve as an insulator.—Stalwart Rubber Co., 362 Northfield Road, Bedford, Ohio.

Quick-release shear pin has its only moving part activated by a silicone-rubber core impervious to temperatures from —100 to 500F, as well as to moisture, oils, alkalies and most acids. Available in various lengths with diameters of one-quarter inch up, or in custom sizes if needed.—Harley Patents, Dept. 12, 607 Fifth Ave., New York.

Rubber compound sealant for high-vacuum applications such as electronic devices, electron microscopes and the like is designated 366YV. Compound is a formula of Buna N Polymer which can be injection-molded into special and standard shapes. Free samples available.—Minnesota Rubber & Gasket Co., Dept. KP, 3630 Woodale Ave., Minneapolis 16.

Photo-sensitive aluminum for use in template making, identification tags and the like is being produced in rolls up to 32 in. wide and any desired lengths. It can be worked using either positives or negative, and no darkroom is required for processing.—Anken Chemical & Film Corp., Newton, N. J.

PRECISION?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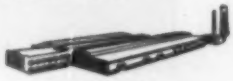

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22nd Annual Aviation Week

MARCH 14, 1955

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will cover vital aviation subjects on global scale

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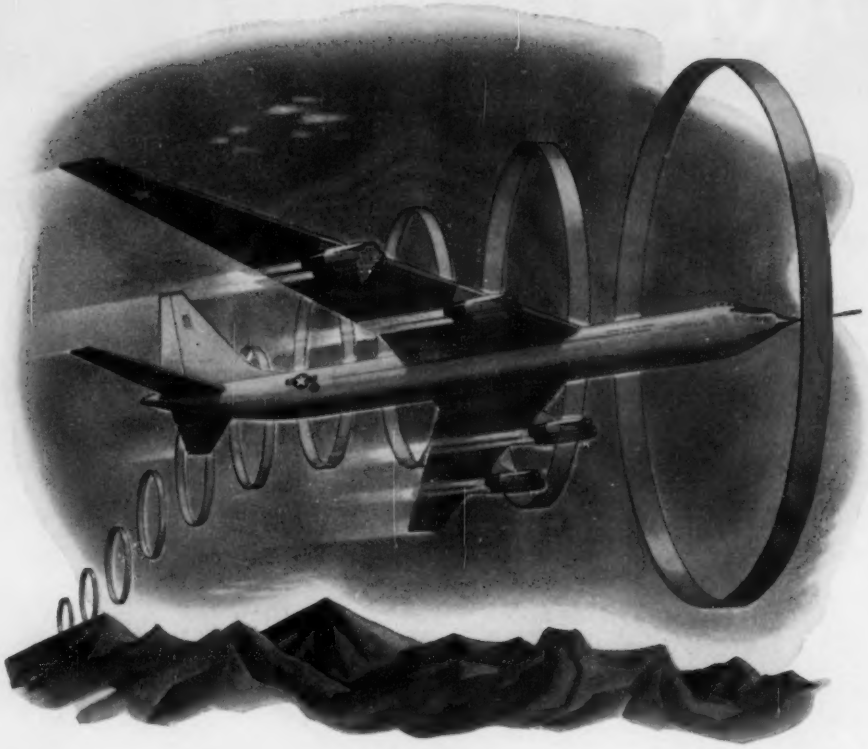

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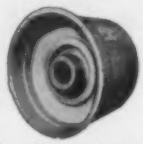
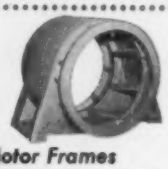
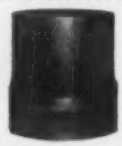
Steel bands formed and flash butt-welded into wheel tire base for industrial trucks.



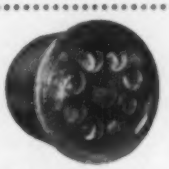
Wheel and Rim Assemblies
Weldment of carbon steel bar and plate for use on heavy earth-moving equipment.



Motor Frames
Steel bars and plate formed and welded into industrial motor frame.

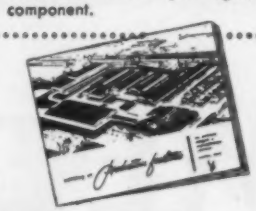


Compressor Cases
Welded band for hermetically sealed refrigerator compressor.



Armature Spiders
Weldment of six parts combining plate and bar stock.

Turbine Frame Assemblies
Formed sheet metal bands and flash butt-welded rings fabricated into a jet engine component.



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70

FINANCIAL

Refinancing Clears Air for TWA

New setup frees airline of heavy near-term maturities, puts it in better position to buy new equipment.

Trans World Airlines is now entering a period of financial stability unmatched in its history. This is a result of its recent refinancing, involving a 15-year general mortgage for $40 million and a short-term bank credit of $10 million.

Certainly, the carrier is in an excellent position to avoid the type of recurrent financial crises to which it was subjected in the past.

▶**New Look**—Seven years ago, in first reviewing the then-tangled financial affairs of TWA, this writer concluded: "At some point, a recasting of the company's capitalization appears inevitable" (AVIATION WEEK May 21, 1948, p. 32).

Circumstances beyond its control forced the company to utilize various temporary financial stratagems during this long interim period that ended recently when this major debt adjustment was effected.

The past difficulties of TWA stemmed largely from the financing accomplished in late 1945 and mid-1946. This was the key: In lending the carrier first $30 million and later an additional $10 million, the loaning insurance company did not insist upon additional equity capital being brought in at the same time.

The loans were assumed to be self-liquidating through depreciation charges. Little consideration appears to have been given TWA's highly leveraged capital structure, where a few adverse developments could and did wreak havoc with the company's finances.

Conditions over which it exercised little or no control—the grounding of the Constellations and a prolonged pilots' strike—forced TWA into some rough financial weather. Funds designed to purchase new equipment had to be used to meet operating expenses.

If the 1945 and 1946 loans had been conditioned upon more equity money being brought into the company at the same time, it is probable that TWA's capital structure would have been sufficiently strong to ride out the storms. For instance, a strong equity base permitted American Airlines to absorb more than $6.6 million in losses for 1946 through 1948 without serious difficulties, despite the issuance of some $40 million in debt in 1946.

The top-heavy character of TWA's debt structure was evident as of Dec. 31, 1948. At that date, total debt amounted to $54.1 million against a revised equity position of $10.2 million, or a debt ratio of 5.4 to 1—an extremely unhealthy situation for an airline.

▶**The Road Back**—TWA's long road to restoration of financial respectability began with the election of Ralph S. Damon as president of the airline early in 1949. The carrier immediately assumed a sense of direction with a healthy morale tone reflected in improved organization and operations.

The financial recovery was made more difficult by TWA's heavy debt capitalization. For example, the company had to create debt senior to that held by the insurance company. Various chattel mortgages were required to finance its postwar re-equipment program. This made TWA the only carrier in its category (the Big Four and Pan American) which had—and still has—debt of the chattel mortgage variety. TWA also had to utilize conditional sales contracts to finance the acquisition of equipment.

▶**Search for Money**—Since 1948, at least five supplemental indentures were executed to revise the original loan agreement and permit additional financing. In order to bring in more equity funds to support its capital structure, three distinct stock flotations were made at relatively depressed price levels.

These flotations exclude an issue of more than $10.2 million in subordinated convertible notes converted into stock at $10 per share in August 1948.

This improvised financing, in addition to placing a heavy burden on the company, also developed a scale of heavy debt maturities, becoming imminent starting in 1955 and requiring some form of modification in 1954. Unless successfully accomplished, new equipment expansion programs could be in jeopardy.

▶**The Patient Rebounds**—But the TWA of 1954 showed a sharp contrast to the financially sick TWA of 1948. According to CAB reports, TWA's total debt aggregated $30.9 million as of Nov. 30, 1954, against a total equity position of $67.4 million. Thus debt accounted for only 31.4% of the total capital structure, compared with 83% almost seven years ago. Moreover, from a book value of only $5.04 per share at the 1948 year-end, the equity increased to around $20.00 per share as of Nov. 30, 1954.

In approaching its recent refinancing,

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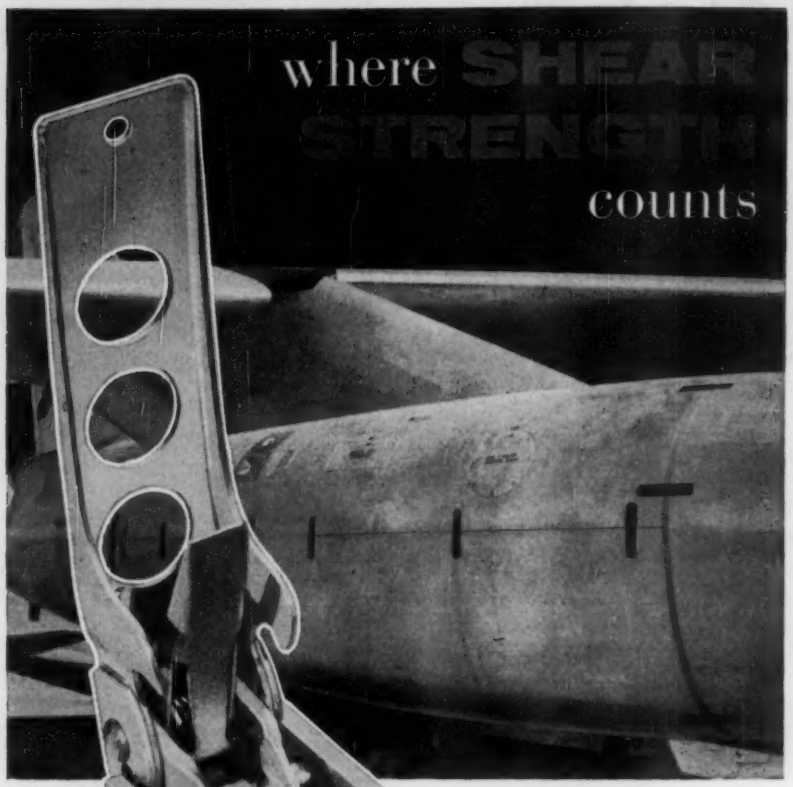

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TWA was therefore able to negotiate from a stronger position that it has occupied during the past seven years.

The successful recasting of debt that was surrounded by past-imposed complicated restrictions was accomplished by TWA's finance vice president, A. V. Leslie. This refinancing serves to remove heavy near-term maturities from the company's back, eliminates the previous debt complexities in their various forms and permits the undertaking of additional equipment programs as needed.

► **Refinancing Details**—As of Nov. 30, 1954, TWA was faced with debt due within 12 months of $11.1 million and, due in 1956, a $16-million debenture debt remaining from the insurance loan (plus other obligations). A bank credit of $25 million was also to have been implemented to help finance 20 Model 1049G Super Constellations scheduled for delivery.

The refinancing has changed all this. The insurance company has made available a new $40-million commitment in the form of a 15-year 3¾% general mortgage due in 1969. Of this amount, $15 million has been taken down initially and applied primarily to refund the $16-million balance due in 1956 on the old insurance loan. The balance of $25 million of the new insurance loan commitment will permit the cancelation of the bank credit of a like amount.

A new stand-by credit, this time of $10 million, has been established with a group of banks, running to June 1957. Against this, $2 million at 3% was drawn down at the 1954 year-end.

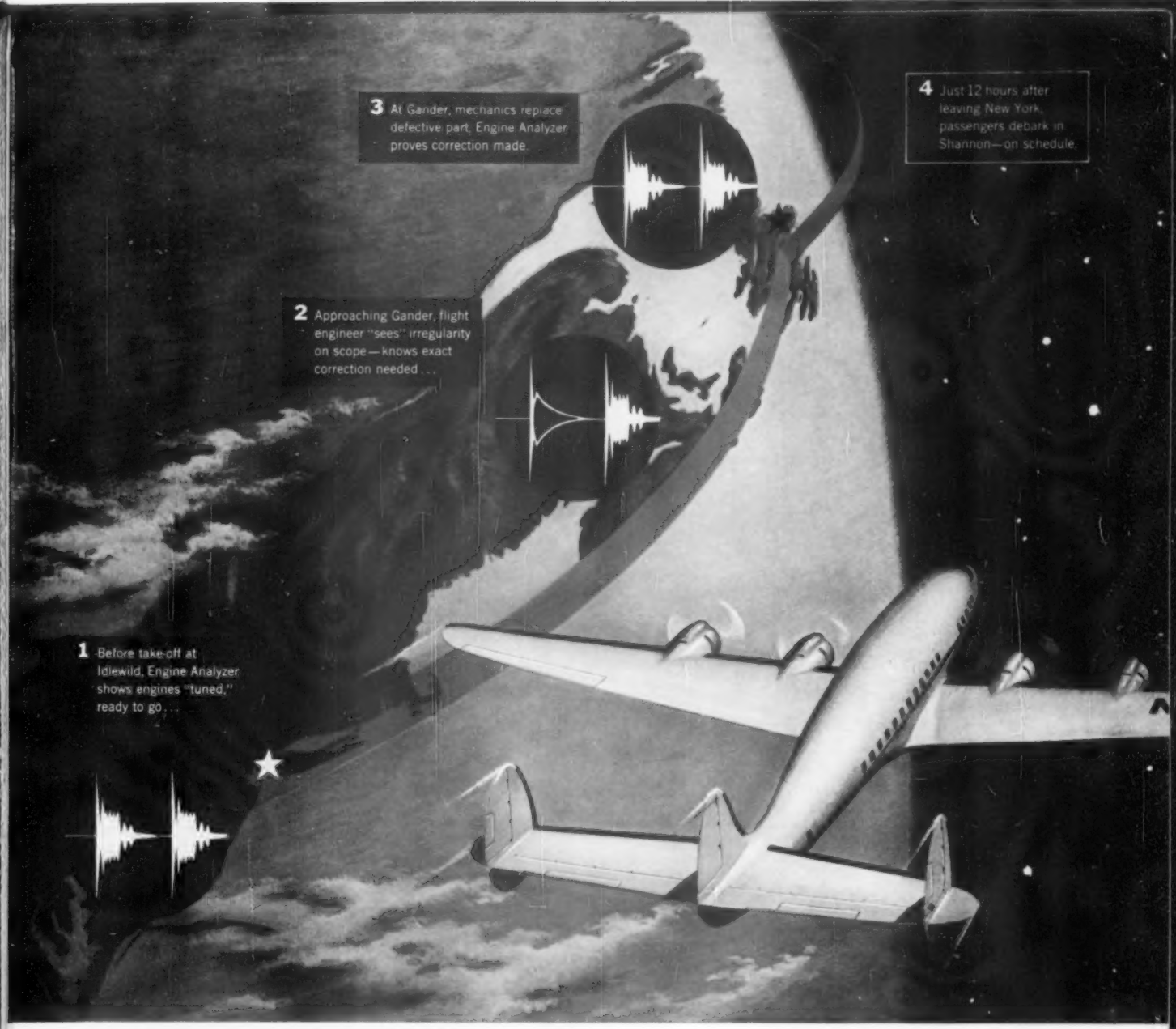
With annual serial payments of equal amounts (around $3.1 million), starting June 30, 1957, and continuing until the insurance loan is retired in 1969, TWA no longer has to contend with heavy near-term maturities. Further, through heavy depreciation charges, cash should build up and afford the company greater financial flexibility.

► **Aircraft Cleared**—While the new insurance loan has a general mortgage on all aircraft now owned and on order, the restrictive "hereafter acquired" clause is now removed. In other words, any new equipment to be purchased in the future will not have to be pledged as security for prior loans.

When the full insurance loan and other credits of about $43 million are outstanding at their peak later this year, and even assuming that equity will be no higher than the Nov. 30, 1945, level, TWA will then have debt comprising less than 43% of its total capitalization.

This broader and stronger capital structure places TWA in an excellent position to withstand the sudden gusts to which air transportation is susceptible. And the insurance company now has a loan that represents a sound credit.

—Selig Altschul


3 At Gander, mechanics replace defective part. Engine Analyzer proves correction made.
4 Just 12 hours after leaving New York, passengers debark in Shannon—on schedule.
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■ Now in use by many of the world's leading airlines, the Sperry Engine Analyzer has taken its place along with Sperry developments like the Gyropilot* Flight Control and Radio Beam Coupler, as another contribution to *safer* flight and more *economical* flight. From the passengers' standpoint, the Sperry Engine Analyzer adds increased dependability in airline schedules. From the airlines' standpoint—lower operating and maintenance costs. *T. M. REG. U.S. PAT. OFF.

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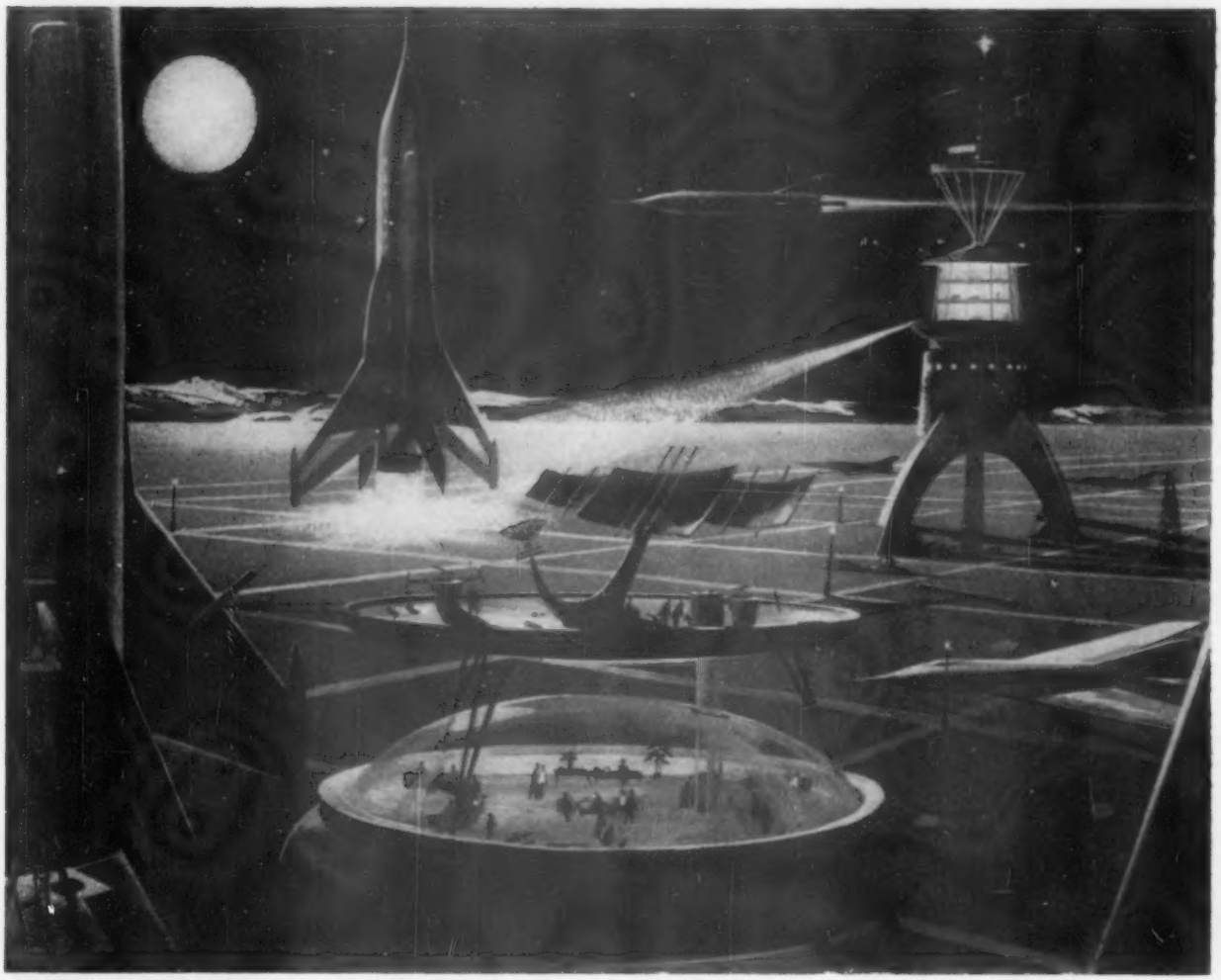


AIR TERMINAL OF FUTURE, envisaged by TWA artist, shows passenger lounge (foreground), vertical-riser transport taking off.

Crystal Gazing at TWA Symposium . . .

How Experts See Air Transport in 1985

By Frank Shea, Jr.

What will commercial air transportation look like in 1985?

This invitation to do a little crystal-ball gazing into the future of the air transport industry 30 years from now was extended to some of the world's foremost aeronautical and astronautical scientists at a Trans World Airlines' symposium in New York last week.

It resulted in these startling predictions by the men who presently are laying the groundwork:

• Dr. Wernher Von Braun, rocket expert and chief of the Guided Missiles Division at Army's Red Stone Arsenal, Huntsville, Ala.

"By 1985, I think we can expect to see commercial airliners flying at altitudes of about 12 miles, nearly three times the altitude they operate at today. . . . They will have speeds of up to 2,000 mph. . . . I don't think that the 1985 commercial airliners will differ greatly in size from today's Super Constellation type, but the overall design will be quite different—certainly the wing design will change.

"Will they be powered by rocket motors? I don't think so. My guess is that airliners will use novel types of jet engines, such as the ramjet. I do think, however, that we will have rocketships, but for a different purpose.

"By 1985, as I have predicted before . . . we'll have a manned space station circling our globe in an orbit 1,075 miles above the earth. This development, I must point out, depends on work beginning on the project now. But I think it's a good bet that within the next 30 years we'll see first an unmanned 'baby' space station—a small instrument-carrying rocket—fired into an orbit say 200 miles above the earth.

"That will be the first step. Then, after science has probed outer space in this gradual manner, man will gingerly venture above the earth's atmosphere in rocketships. Finally, after all these experiments, man will erect a huge space station and the last great adventure can begin—the conquest of space."

• Hall Hibbard, vice president-engineering, Lockheed Aircraft Corp.

Hibbard lowered Von Braun's esti-

mate of cruising speed by 500 mph., predicting that "in 30 years' time supersonic commercial transports will be flying regularly on the airlines, cruising at 1,500 mph., with ability to fly from Los Angeles to New York in approximately one hour, 45 minutes. These flights will be made at altitudes of approximately 80,000 ft.

"Shorthaul city-to-city service will be accomplished by vertical-rising feederline aircraft carrying 50 passengers, with a cruising speed of 500 mph.

"Due to the low-cost carrying ability of turbo-propeller cargo airplanes, the freight and cargo business will be the major revenue producer on the airlines, eclipsing even the passenger business. All mail and parcel post will be carried by air. Nuclear-powered passenger planes will be flying and might possibly be in airline service."

• Dr. Fred L. Whipple, chairman of Harvard's Department of Astronomy and co-author of "Conquest of the Moon."

Whipple also looked to nuclear power, saying: "My guess is that 30 years from now we'll have extremely fast, extremely comfortable high-altitude planes, with some powered by atomic energy. These planes will use jet propulsion as a motivating force, but the power will be derived from some sort of nuclear conversion plant. In other words, a marriage between atomic energy and jet propulsion.

"I also think that tomorrow's commercial airliner will be a converter-type, capable of rising directly off the ground like a helicopter. On reaching the desired altitude, it will convert to the conventional role."

Whipple took issue with Von Braun on size of future airliners, however, holding that "because powerplants will be much heavier, we can expect aircraft to be much bigger. . . . This will mean greater comfort for the passenger. For example, passengers could be situated in the wings rather than the body of the plane. . . . Imagine the magnificent panoramic views travellers may have from private compartments, lounges or seats situated in the wings of tomorrow's de luxe airliners!"

He also added his vote to the belief that we will have a foothold in space within the next 30 years. "My guess is that we'll have developed automatically controlled, robot-like rocketships capable of speeding far out into the unknown of space. These unmanned vehicles will be the forerunner of manned space flight."

• Edward C. Wells, vice president-engineering, Boeing Airplane Co.

Somewhat more cautious, Wells expressed the belief that predictions should be held to within the next 10 years.

"Surely within the next decade we will see jet transports widely accepted on airline routes of the world, although the piston engine will still play an important role and the turboprop will, I believe, find its proper place in the efficient transportation of cargo and passengers at medium high speeds.

"As for supersonic transportation and nuclear propulsion for aircraft, I believe the former could be undertaken now, technically speaking; but it could not be expected to be economically competitive at present. The possibilities of development in nuclear propulsion are tremendous, but it is probable that this type of propulsion will for some time be limited to military use."

• J. Geoffrey Notman, president and general manager, Canadair, Ltd.

Predicting a growth in traffic volume on the world's airlines to about 15-20 fold or 500,000 million passenger-miles annually, Notman estimated that this traffic will be handled by an aircraft fleet three times the size of today's, with twice the average seat capacity and 50% higher average speed.

"I expect all of these aircraft to be turbine powered, although by different adaptations to suit various purposes—such as bypass engines for highspeed longhaul passenger traffic, propeller turbines with big load capacity, and moderate speeds for coach and cargo traffic, and various vertical-takeoff schemes for local or shortrange operation.

"I further expect these aircraft to employ the latest developments in the field of boundary-layer control and noise abatement."

Expressing a personal wish, Notman said he hopes the 1985 airline passenger will not have to walk through rain and snow to board an aircraft and will get his baggage without delay after disembarking.

• F. B. Rentschler, chairman, United Aircraft Corp.

Holding that solid progress is indicated rather than revolutions or miracles, Rentschler predicted that within the next 30 years commercial transports will continue to improve steadily in speed, safety and comfort, and in approximately 10-year cycles.

"Whether jet, nuclear-powered or rocket type is immaterial," he said. ". . . In my judgment, maintaining the integrity and ability of our aviation industry is the single most important factor."

• Arthur E. Raymond, vice president-engineering, Douglas Aircraft Co.

"In 1985, I should expect all current civil aircraft models to be still in service somewhere, and perhaps—who knows?—airlines will still be looking for a DC-3 replacement. On the other hand, the vast majority of the commercial fleet will consist of turbine-powered aircraft."

Striking another conservative note, Raymond said he does not expect many aircraft to be flying at supersonic speeds because of the cost. He estimated that volume of airline traffic, especially in coach and cargo categories, will be multiplied several times over.

"There will not be much growth in size of aircraft, but there will be much more frequent schedules and many new routes."

• Gen. Joseph T. McNarney, president of Convair, Division of General Dynamics Corp.

"Imagineering into the future is a risky business, but in consideration of the progress made in the first 50 years of aviation history, the prospects for the next 30 or 50 years leave one almost breathless."

McNarney said it should be remembered first of all that future trends in aircraft design will continue to be dictated by demand, price, technical limitations and capabilities, and operating costs.

"It is conceivable," he said, "that within the span of time longrange commercial air speeds will reach 1,500 mph. Intermediate-type aircraft—with primary emphasis on such things as short-field takeoff and landing characteristics, new loading and unloading arrangements and all-weather navigation and approach systems—may reach speeds of 850 mph.

". . . Another aspect of aviation which we at Convair believe will expand tremendously in the future is the aerial hauling of freight. If electronics systems are developed for accelerating the paper work in freight handling and if transportation packages universally adaptable to air and ground transport systems are popularized, we believe the airfreight business will progress to the point where it will be cheaper per pound-mile to haul freight by air than it currently costs to move it by truck, ship or rail."

• William B. Stout, a pioneer designer of all-metal aircraft.

"No man has imagination enough to

$100,000 in Prizes

Trans World Airlines' president Ralph S. Damon, noting TWA's "30 years of service anniversary" and emphasizing the airline's interest in the progress of the next 30 years, has announced a $100,000 prize competition intended to stimulate advanced thinking in aircraft design.

TWA will offer a grand prize of $50,000 to the person, his heirs or assigns, who this year submits the most accurate description of commercial aviation 30 years from now.

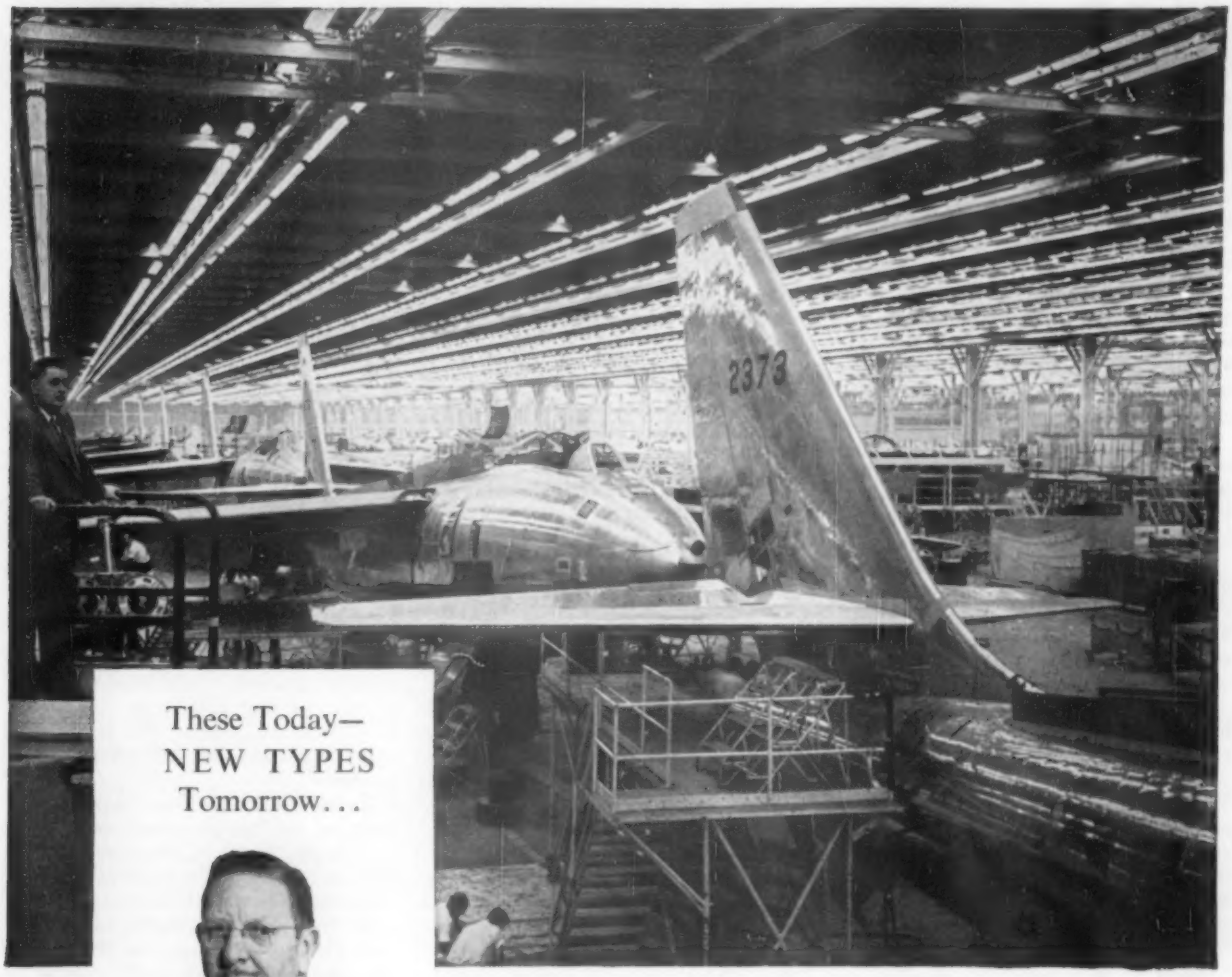
All entries will be placed in a sealed repository at TWA's new maintenance base at Kansas City, Mo., and will be judged in 1985.

predict the vastness of flying 30 years

only a few minutes, with most of the

Airlines from Portland, Seattle-Tacoma

Aircraft Engineers



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predict the vastness of flying 30 years from now. "The giant achievement of the past decade will be pygmy by comparison."

• John Jay Hopkins, chairman and president, General Dynamics Corp.

"Though its (atomic airplane's) military worth as a deterrent to aggression seems inestimable—its peaceful applications, I feel, are equally boundless.

"I expect to see in my remaining lifetime fleets of commercial atomic passenger and cargo planes, free of fuel problems and providing cheap, comfortable transport between points fixed only by the dictates of commerce. The atomic airplane will certainly prove out the dual destiny of the atom—to deter and to create."

• George R. Edwards, managing director, Vickers Armstrongs, Ltd., Aircraft Division.

"I believe that the airplane 30 years hence will . . . still be quite clearly an airplane by 1955 standards and will not be confusable with any of the illustrations from the spaceship comics.

"There will still have to be a fuselage to carry the passengers, wings to sustain them and engines to provide thrust. The engines may be gas turbines or even atomic, and there may well be some direct lift devices incorporated.

"Human nature, however, is not likely to change much in 30 years, and economy of operation is still liable to be the key point in airliner design. Wings are as cheap a method of getting and keeping an airplane airborne as any, and I still expect to see them used in 1985."

• G. S. Trimble, vice president-advanced design, Glenn L. Martin Co.

". . . Maximum progress must await application of a motivation superior to the fear of war. Yet, optimism in considering this factor leads me to believe that essentially all commercial transportation in 1985 will be via air in vehicles operating on principles not yet conceived."

• Dr. Walter R. Dornberger, guided missile consultant, Bell Aircraft Corp.

"If rocket propulsion comes into its own by 1985, the commercial air transportation picture will be far different from today. As a matter of fact, it may be somewhat different from our forecasts even now.

". . . Some of today's scientists, myself included, are thinking in terms of rocket-propelled airliners which will travel at speeds in the vicinity of 10,000 mph. at altitudes up to 150,000 ft. Fantastic, probably, in light of modern requirements—but entirely possible.

"Flights from San Francisco to Sidney, Australia, a distance of more than 10,000 miles, could be made in one and one half hours. New York and London and Paris would be comparably close.

"Powered flight would be limited to only a few minutes, with most of the distance being covered in a long, shallow dive. Much of the flight would be at high altitudes where the atmosphere is extremely rarefied.

"This would be accomplished with a rocket aircraft built in two parts. The passenger section would ride piggy-back on a larger section, which would provide the power for takeoff and about two minutes of flight. The latter then would return to the base of origin.

". . . I have pointed out that intercontinental rocket travel is a possibility. It will come about only if funds are provided for the necessary research and development. The rocket and aerodynamic know-how we now have."

Alaska Decision

- **Board recommends two carriers handle service.**
- **Northwestern delegates voice strong opposition.**

By Katherine Johnsen

A recommendation by Civil Aeronautics Board to eliminate two small carriers from Pacific Northwest-Alaska air service, leaving the operation to two major trunklines—Pan American World Airways and Northwest Airlines—has aroused strong congressional opposition. The recommendation is the Board's decision in the States-Alaska case, now pending at the White House and still officially secret, as disclosed by members of the Oregon and Washington delegations. The six-member Oregon delegation and the nine-member Washington delegation, as well as E. L. Bartlett, the delegate from Alaska, have petitioned the President and each of the members of CAB, demanding renewal of the certificates of all four scheduled air lines serving Alaska from their states.

▶ **Subsidy Reduction**—"The CAB, by a recent vote, has decided to eliminate Pacific Northern Airlines and Alaska Airlines from Portland, Seattle-Tacoma service and to confine both carriers to intra-Alaska routes on which they are permanently certificated," the Oregon delegation's letter to the President says.

Subsidy reduction presumably figured importantly in the Board's decision. CAB anticipates the subsidy requirement of Pacific Northern and Alaska Airlines will increase from $2 million in fiscal 1954 to $2.3 million in fiscal 1955. The two carriers receive a low service mail rate of 47 cents a ton-mile.

CAB's proposal is at odds with the recommendations of both its examiner and its Bureau counsel:

• Chief examiner Francis Brown proposed renewal of the certificates of PAA, Northwest and Pacific Northern. But Alaska Airlines' authority to operate to the Pacific Northwest, he said, should be discontinued and its system should be integrated with that of Pacific Northern (AVIATION WEEK Aug. 9, 1954, p. 48).

• Bureau counsel Arnold Berkeley recommended retention of the services of PAA and PNA and the abandonment of those of Northwest and Alaska Airlines (AVIATION WEEK Aug. 23, p. 56).

"The routes of the four airlines involved . . . should be unchanged," the Oregon delegation declared. "Competitive air service between the Pacific Northwest and Alaska will be continued, monopoly in air service thus avoided."

▶ **Undue Hardship**—The delegation also objected to "postponement of a decision on the States-Alaska case until the CAB has completed a contemplated investigation of intra-Alaska air routes and operators . . . because such action would work an undue hardship on the carriers involved in their efforts to process financing essential to their service and facilities."

To justify operation by four lines between Alaska and the Pacific Northwest, delegate Bartlett points out in a letter to CAB that since PNA and ASA were certificated in 1951, in addition to PAA and Northwest, "Both the air traffic of the scheduled carriers as well as the population of their terminals in Alaska—Fairbanks and Anchorage—have virtually doubled in size."

Between 1950 and 1953, he says:

- The population of Anchorage increased 97% and Fairbanks, 87%.
- Air cargo shipments to the two cities mounted 96%, from 8.6 million pounds in 1950 to 16.9 million pounds in 1953.
- Passenger traffic jumped 134%, from 45,820 to 107,034.

Termination last fall of the passenger service of Alaska Steamship Co., which carried 18,668 passengers between Alaska and the U.S. in 1953, Bartlett argues, "means that in 1955 and in succeeding years more, not less, air service will have to be provided . . ."

New 'Nonsked' Flight

North American Airlines will add roundtrip DC-6B flights to its New York-Miami service Feb. 7, with daily departures for Florida at 12:30 p.m.

The large nonscheduled air carrier says the DC-6B will make the flight from New York to Miami in 3 hours 55 minutes, cutting current DC-4 time by an hour and a half. North American is planning to begin flight in the near future from New York to Bermuda, Nassau and "many other points."

American, ALPA Bury Hatchet

American Airlines and Air Line Pilots Assn. finally have reached a settlement of their differences.

They accepted mediator David L. Cole's recommendations that American be permitted to continue flying westbound nonstop DC-7 flights in excess of eight hours (Aviation Week Nov. 8, 1954, p. 96). In return, pilots of these flights will receive, in addition to their regular flight pay and flight time credit, extended flight pay and credit computed on the "greater of actual or scheduled time."

Each first pilot will be paid an extra $1.50 for every hour flown on the entire trip. Co-pilots will receive an extra $1 for every hour. For all flight time in excess of eight hours on any flight, pilots will receive an amount equal to 50% of their earnings for the extra time.

In addition, for all flights in excess of eight hours, pilots will get credit for 50% of the extra time.

Both sides also have agreed to withdraw or discontinue all complaints or charges currently pending in the courts, or before regulatory agencies or boards.

In a letter to the American pilots, union president Clarence L. Sayen, said: "Although the agreement concluded may not represent the perfection desired by your representatives, it is believed that it constitutes a constructive implementation of the association's policies with regard to daily flight time limitations. . . .

"You will note that Mr. Cole indicates he feels that this is an appropriate solution to the problem as it exists on American Airlines. It is not necessarily the solution with other carriers where the operational problems may differ."

Jet Streams

- **PAA cuts trans-Atlantic time with paper flights.**
- **Tests set up best routes for turbojet transports.**

Aided by high-altitude jet streams, Pan American World Airways is operating New York-London flights three times a week in little more than six hours—on paper.

"Flight 1000," as the paper flight is called, is an integral part of PAA's overall research program designed to determine the fastest trans-Atlantic routes to be used in the era of jet airliners.

▶ **Jet Stream Study**—The company's research into the Atlantic's high-level winds stems directly from its jet stream experience over the Pacific. A year-long study has been completed and shows Atlantic jet streams can be plotted to speed schedules, although they follow a more winding, shifting path than over the Pacific.

In a complete report on their findings, PAA's meteorologists say the basis for their findings was the operation of Flight 1000 across the Atlantic three days a week in both directions. Called "Clipper X," the plane cruised at an average speed of 500 mph. and flew at its best operating levels—between 34,000 and 44,000 ft.

▶ **Maximum Tail Winds**—By a system of careful projection of international daily weather reports across the Atlantic and constant reports from planes over the ocean, it was possible to reduce the flying time of the paper jet consistently by as much as 55 min. The extra speed was picked up from New York to London by following a flight path that took maximum advantage of the tail winds. In the other direction, the time saving was about the same because the "pilot" was told how to avoid the strongest headwinds.

Routine plotting of least-time tracks has been in effect at Pan American's dispatch offices in New York and London for the past two years. Because of the limitations of the Boeing Stratocruiser and the Douglas DC-6B in cruising altitude, greatest advantage of the jet streams still is to be taken.

▶ **Direction, Intensity**—PAA's meteorologists say the jet streams "are probably the most significant and persistent features of the weather aloft in the North Atlantic" but they "tend to move around a great deal and will vary from season to season in direction and intensity." The meteorologists report that most streams in the North Atlantic move from northwest to southeast or from southwest to northeast, with variations from day to day.

Because of this daily variance, says Pan American, the only really satisfactory results must be obtained by actually working out a flight plan for each flight. The difference between the overall average ground speed and the true airspeed (corrected for altitude and temperature) is then the equivalent head or tail wind.

"We have done this three times a week for an aircraft with an assumed true airspeed of 500 mph. This is directly applicable to jets now on the drawing boards which promise speeds of 550 mph."

PAA is the only airline maintaining regularly scheduled flights in the jet stream across the Pacific, cutting seven hours from its Tokyo-Honolulu flight.

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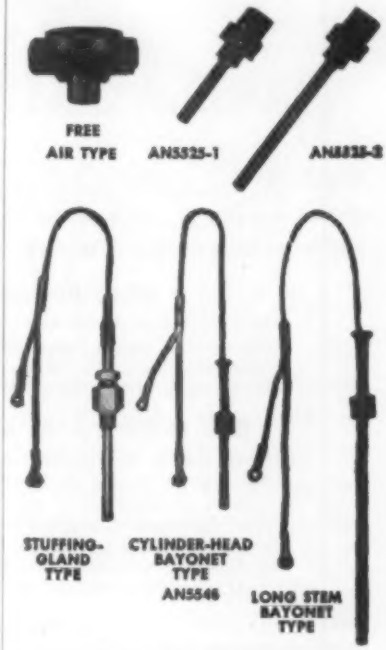

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AN5525-1 and AN5525-2 standard type with ⅝—18 threaded head, hermetically sealed. These bulbs exceed the response and operating temperature requirements of specification AN-B-19.

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CAA Orders Check Of Convair 340s

An emergency airworthiness directive calling for inspection of elevators in Convair 340 control systems has been issued by Civil Aeronautics Administration.

The action resulted from a flight accident in which a United Air Lines Convair had to make an emergency landing. UAL grounded all its Convairs temporarily while the trouble was corrected.

Loss of elevator control was attributed to failure of the axle bolt that attaches the servo tab idler bell crank to the left hand stabilizer. CAA will require inspection of control systems as soon as practical, but not later than the next 15 hours of service.

Inspection is to be made of all CV-340 control systems for the servo tab on the left elevator and on the right elevator trim tab. It should cover all nuts, bolts, idlers, bell cranks, push rods and fittings and make sure there are no loose or missing parts or cracks.

A general security check should be made of all nuts and bolts.

CAB ORDERS

(Jan. 13-19)

GRANTED:

Northwest Airlines' application for elimination of Aberdeen, S. D., from its certificate for Route 3.

Shulman, Inc., leave to file exceptions late to the examiner's report in the airfreight forwarder investigation.

APPROVED:

Agreements involving Capital Airlines, Northwest Airlines and various other carriers.

ORDERED:

Investigation and suspension of certain rates filed by Standard Airways for charter of DC-3, C-47 type aircraft.

Suspension of certain Pan American World Airways' fares be extended to Apr. 29.

Air Service's letter of registration reinstated.

DENIED:

Flying Tiger Line an exemption to perform certain charter flights for the Intergovernmental Committee for European Migration.

DISMISSED:

Delta C&S Air Lines' and Northeast Airlines' application for approval of a merger agreement, with the agreement of Delta and NWA counsel.

Investigation and suspension of certain Transocean Air Lines fares, since the fares have been canceled.

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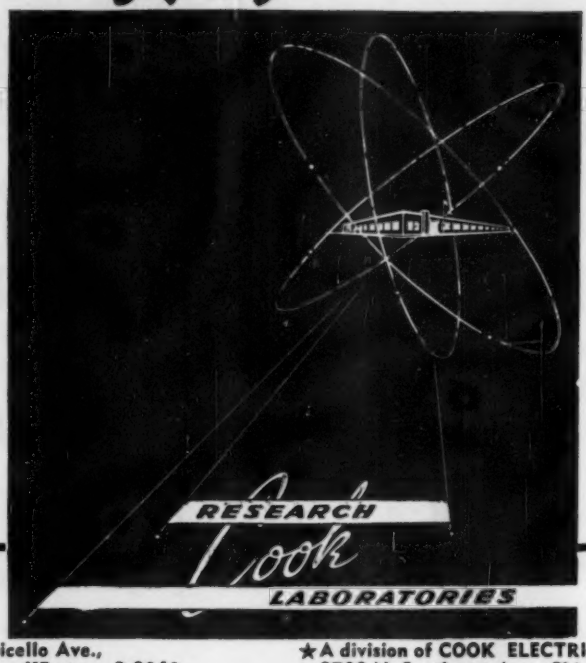

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P-5174, Aviation Week
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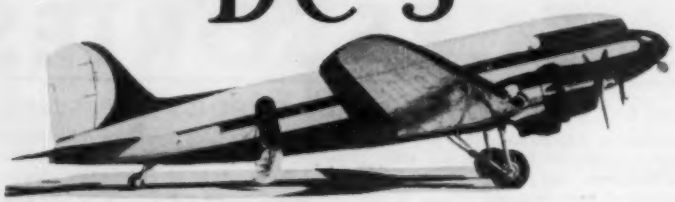

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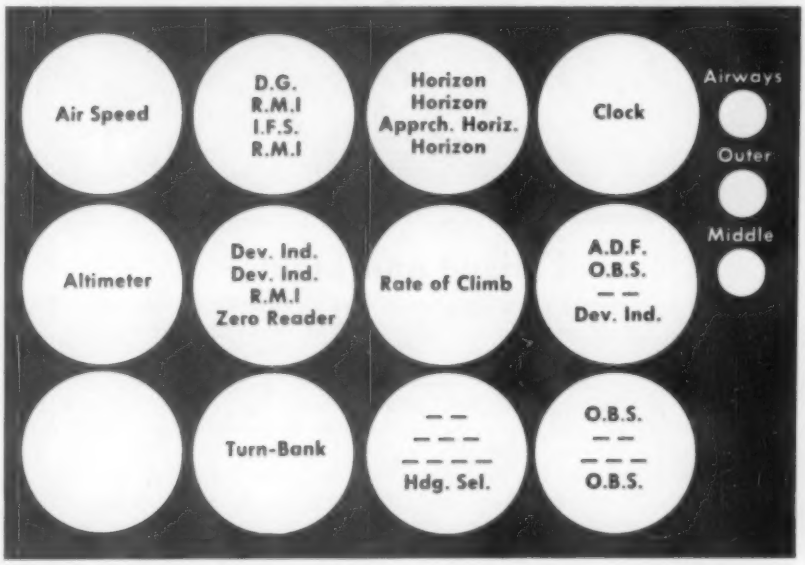

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COCKPIT VIEWPOINT

By Capt. R. C. Robson

Fatigue and Lights

Airline accidents, while always tragic, vary considerably in interest. The crash of the Italian Airlines DC-6 at Idlewild in December may prove to be as interesting as any.

Right from the start, general magazine and newspaper reporting displayed a startling knowledge of flying and presented some rather accurate discussions of the possibilities. This was quite some contrast to the inaccurate drivel that usually follows such an event.

► **The 'Best System'**—For instance, Time magazine headlined its story "The Hated Slopeline." Now what could be more accurate than that? Then Time continued with a worthy discussion of some of the finer points of making an instrument approach and the problems of transition to visual flight.

The only error in the Time story was reference to the slopeline lights as being "good theoretically." This is wrong. There isn't a shred of common sense attached to the whole mess. Of course it did mention "the best system of all"—the ALPA-ATA lights at Newark; so that somewhat atoned for the sin.

Several stories mentioned the fatigue angle, and even the noted author William Faulkner was moved to write on the subject.

► **Two Theories**—Although it is difficult to agree with his somewhat romantic notion about the religious awe that people have of machines and gadgets, part of his piece is worth quoting.

"I imagine that even after the first failure to hold the glidepath, certainly after the second, his instinct—the seat of his pants, call it what you will—after that many hours in the air, told him that something was wrong. And his seniority as a four-engine over-water captain probably told him where the trouble was. But he dared not accept that knowledge and act on it."

That may be right, but you want to know what I think? I'll bet Capt. Algarotti's seat of the pants told him that he was tired and ought to be home in bed. I know that's what the seat of my pants tells me after 18 or 30 hours or whatever it was.

► **Pilots Get Tired**—Multiple crews or not, rattling around in any airplane for that length of time is not a happy pre-requisite to an instrument approach. Last year we had a major airline strike over this matter of flying and fatigue and safety.

But for some obscure reason, the world just doesn't want to accept the idea that pilots get tired.

And it is not only on these long overseas flights, either. Many pilots jounce up and down on local domestic operations for 12, 14 or 16 hours a day, and after four or five days the cumulative effect is slightly wearing.

It always is wrong to judge an accident until all the facts are in, but it is going to take some mighty strong facts to convince many people that this was not a case of fatigue and mistaking those "hated slopeline" lights for the runway. It has been done too many times in the past.

The one bright spot so far is that Idlewild is to get a centerline lighting system with hope for a second installation in the future. This is good. The one remaining hope is that the other slopeline lights don't have to be removed in the same forcible manner.

(Editor's Note: Aviation Week gives Capt. Robson an opportunity to express himself freely in this column. Comments from readers on his opinions are welcome.)

AVIATION CALENDAR

Feb. 8-10—National Association of State Aviation Officials, winter meeting of board of directors, Lafayette Hotel, Washington, D. C.

Feb. 8-10—Society of the Plastics Industry, 10th Reinforced Plastics Division conference, Hotel Statler, Los Angeles.

Feb. 10-11—Society of American Military Engineers, military-industrial conference on manpower, Conrad-Hilton, Chicago.

Feb. 11—Air Transport Command, 10th reunion dinner of World War II officers, Waldorf-Astoria Hotel, New York.

Feb. 20-22—Fourth annual Texas Agricultural Aviation Conference, A&M College of Texas, College Station, Tex.

Feb. 20-22—Institute of Surplus Dealers, trade show and convention, 212th AA Armory, New York.

Feb. 21-22—National Model Plane Show, Higbee Co. auditorium, Cleveland.

Feb. 23-25—Fourth annual Ohio-Indiana Agricultural Aviation Conference, Purdue University, Lafayette, Ind.

Feb. 26-27—Associated Glider Clubs of Southern California, ninth annual Pacific Coast Mid-Winter Soaring Championships, Torrey Pines Glider Port, San Diego.

Mar. 11—Institute of the Aeronautical Sciences, National Flight Propulsion Meeting (restricted), Hotel Carter, Cleveland.

Mar. 14-16—Society of Automotive Engineers, production meeting and forum, Netherland Plaza, Cincinnati.

Mar. 14-18—American Society of Tool Engineers, first Western Industrial Exposition, Shrine Auditorium and Convention Hall, Los Angeles.

Mar. 20-23—Aero Medical Assn., 26th annual meeting, Hotel Statler, Washington, D. C.

Mar. 21-24—Institute of Radio Engineers, national conference, Waldorf-Astoria Hotel and the Kingsbridge Armory, New York.

Mar. 28-Apr. 1—American Society for Metals, ninth Western Metal Exposition and Congress, Pan Pacific Auditorium and Ambassador Hotel, Los Angeles.

Mar. 31-Apr. 1—Symposium on Boundary Layer Effects in Aerodynamics, Britain's National Physical Laboratory, Teddington, England.

Apr. 5-7—Radio Technical Commission for Aeronautics, spring assembly and joint meeting with the Institute of Radio Engineers, Los Angeles.

Apr. 6-10—World Plastics Fair & Trade Exposition, National Guard Armory, Los Angeles.

Apr. 14-15—American Ordnance Assn., two-day symposium of Proving Ground Instrumentation Committee, Patrick AFB, Fla.

Apr. 16-20—American Association of Airport Executives, 1955 annual convention and business meeting, El Conquistador Hotel, Tucson, Ariz.

Apr. 18-21—Society of Automotive Engineers, Golden Anniversary Aeronautic Meeting, Aeronautic Production Forum and Aircraft Engineering Display, Hotel Statler and McAlpin Hotel, New York.

EDITORIAL

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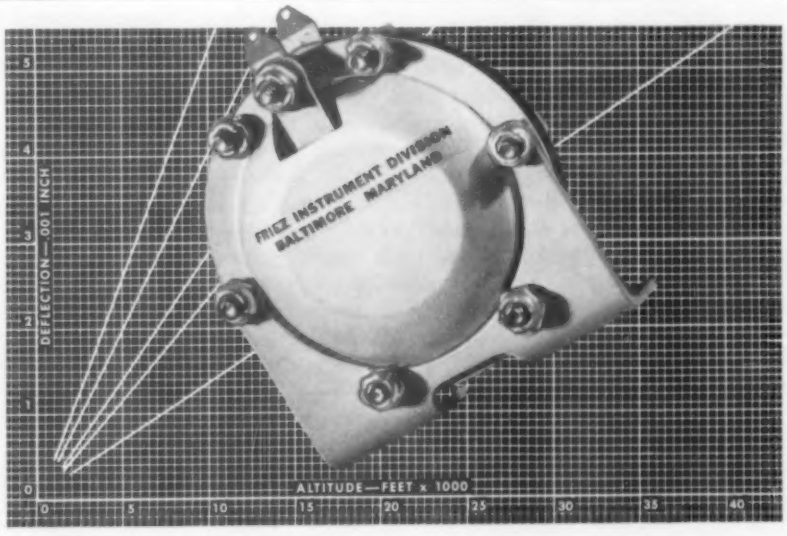

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EDITORIAL

The New Airpower Budget

The aircraft manufacturing industry will be particularly interested in the fiscal 1956 Defense budget request submitted to Congress in mid-January. It is the first time the Eisenhower Administration has had to face squarely the financial facts of building and maintaining national airpower second to none. It is to their credit that they did not flinch. The $7 billion requested for new aircraft procurement by the Air Force, Navy and Army represents the actual cost of military plane production required to maintain and modernize the airpower force levels established by the present Administration two years ago.

This $7-billion procurement level is a more realistic gauge of the annual production level required for the aircraft industry to meet current military goals than the $4.8-billion and $4.6-billion appropriations in 1954 and 1955. These low aircraft procurement appropriations stirred grave doubts in some quarters that the Eisenhower Administration really meant what it said about relying on airpower as the nation's first line of defense in the nuclear "age of peril." These sub-minimum appropriations were possible only because of carryover funds from the $44 billion voted for aircraft production by the Truman Administration in the panic that followed outbreak of the Korean war in 1950.

Here is what happened. By 1950, the aircraft industry was making slow recovery from its postwar slump and operating at about a $2-billion annual production level. When the shooting began in Korea, Congress met the crisis with huge military airpower appropriations totaling $44 billion for new aircraft production in fiscal years 1951-53. Congress and the American people again learned the bitter lesson of 1941-42 that you cannot build airpower overnight no matter how much money you pour into production.

During these three years of the Korean war, the aircraft industry was able to produce only $15 billion worth of hardware. The aircraft industry was getting money almost three times as fast as it could be productively absorbed. This was the period of "buying everything from everybody" in frantic haste to put some flesh on the skeleton of American airpower.

But not until three long years of expanding plant and production facilities and battling the old familiar bottlenecks of machine tools, materials and manpower was the aircraft industry able to reach an annual output of about $8 billion.

This situation gave the incoming Eisenhower Administration a cushion of about $29 billion in unexpended aircraft procurement funds with which to operate during the fiscal years 1954-55. At the same time, the end of the Korean war provided an opportunity for a realistic appraisal of the aircraft production program and a subsequent re-adjustment, culling projects of doubtful military value and excessive cost and stabilizing production of promising projects. While the re-evaluation was under way, the Eisenhower Administration was able to get along with small requests for new aircraft appropriations and use the money left on the books by the Truman Administration to make up the difference. This fact produced some claims of military economy reminiscent of the Louis Johnson pre-Korean battlecry of "cut the fat but not the muscle." These claims were as spurious in 1953 as they were in 1949.

However, USAF did what is now generally accepted as a creditable job of weeding the "cats and dogs" from its production program and concentrating money on technical developments that met both military requirements and performance standards. This saved the industry a great deal of eventual public embarrassment and the taxpayers considerable money although individual manufacturers affected were understandably unethusiastic. About the same time, the Navy was running into technical roadblocks, notably in jet engines, that also forced a screening and re-programming of its aircraft production.

Now with the industry rolling along relatively smoothly after the hectic 1950-53 period and the excess funds from the Truman Administration committed, the present Administration has had to calculate the full annual airpower bill in its own budget. The Administration estimates that $7 billion will do the job and this should be reassuring news for the aircraft industry. For $7 billion is not far below the sales level for 1954—the most prosperous year in the industry's postwar history. And it is more than three times the pre-Korean peak.

Democrats now in control of Congress may argue that the $7 billion requested by the Republicans is not enough to provide the quantity or quality of new aircraft required for air supremacy and demand more. That debate will begin shortly on Capitol Hill.

But whatever its outcome, it is clear that the stability and prosperity of the aircraft industry will not fall far below its current level during the remaining years of President Eisenhower's current term.

ARDC's Fifth Birthday

Fifth birthday of the Air Research and Development Command on Jan. 23 marked a significant milestone in the long, hard fight to emphasize quality in the development and production of aerial weapon systems. The survival and progress of ARDC since it was born in Dayton five years ago as a step-child of Air Materiel Command has been an accurate gauge of the growing importance of technological superiority in the outlook of the USAF high command. During this same period, the voice of research and development was elevated to the rank of an assistant secretaryship in the USAF civilian hierarchy and the role of deputy chief of staff for development was greatly strengthened on the air staff.

After a rugged beginning, during which the able leadership and stout resolution of Gen. Earle Partridge and Lt. Gen. Donald L. Putt kept ARDC from foundering on political reefs, the partnership of quality and quantity seems firmly established from the highest levels of USAF in the Pentagon down through the Weapons System Project Offices to the working level of both USAF and the industry that serves it.

—Robert Hotz

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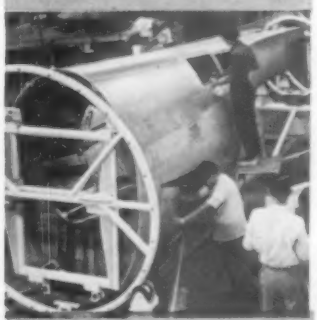
F-84F Thunderstreak Aft Fuselage on Temco production line.



B-47 Stratojet Aft Fuselage Section on Temco production line.

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